The use of derivatives in the mining sector: a comparative analysis of companies listed in South Africa, Australia and the UK

Presented to

UNIVERSITY OF CAPE TOWN

In partial fulfilment of the requirements

for the degree of

Master of Commerce (Financial Management)

by

Mark Joel Greenbaum

Supervisor: Professor Carlos Correia

January 2011

Abstract

This study investigates whether significant differences exist between South African, Australian and United Kingdom mining corporations in terms of derivative usage. The study further investigates whether such differences or similarities are due to size differences, specific mining industry sector differences, or are as a result of specific derivatives being more prevalent in a particular region of the world. The results obtained were then posed to industry insiders for their particular interpretations. In addition, information related to their experiences of derivatives in the mining sector was canvassed in order to develop a composite appreciation of current derivative usage in the industry.

Using listed mining entities from the three markets respectively, the results were analysed and found to have significant sovereign disparities in terms of derivatives usage. Furthermore, the industry participants concluded unanimously that derivatives had minimal benefit in the mining industry, barring short term coverage of certain cash flows. The study concludes with the view that overbearing downside risk far outweighs any potential gain from long term hedging activities.

Acknowledgements

I would like to thank my supervisor, Professor Carlos Correia, for his support and encouragement throughout the process of completing this thesis, as well during the rest of the year. I would especially like to express my gratitude for his calming influence and his dissemination of years of invaluable insights.

Although I cannot name my interviewees, due to confidentiality issues, I would really like to express my gratitude for their generosity, particularly in light of their busy schedules. Thank you for giving me a chance to see inside your world.

I would like to thank my Mom, Dr. Lesley Greenbaum, for her invaluable input, time and effort that made the completion of this thesis possible. Her guidance and patience are greatly appreciated. Her insight and support encouraged me at all times.

I would like to thank my Dad for his inspiration and always being a role model of integrity, as well as my sisters Sara and Tammy, and wonderful girlfriend Sal for their encouragement and support.

I certify that it is my own work and all references used are accurately reported in the text.

Terms used[1]

Term :	Definition:
Bullion Option	A transaction in which one party grants to the other party (in consideration for a premium payment) the right, but not the obligation, to purchase (in the case of a call) or sell (in the case of a put) a specified number of Ounces of Bullion at a specified strike price. The option may be settled by physical delivery of Bullion in exchange for the strike price or may be cash settled based on the difference between the market price of Bullion on the exercise date and the strike price.
Bullion trade	A transaction in which one party agrees to buy from or sell to the other party a specified number of Ounces of Bullion at a specified price for settlement either on a "spot" or two-day basis or on a specified future date. A Bullion Trade may be settled by physical delivery of Bullion in exchange for a specified price or may be cash settled based on the difference between the market price of Bullion on the settlement date and the specified price. For purposes of Bullion Trades, Bullion Options and Bullion Swaps, Bullion" means gold, silver, platinum or palladium and "Ounce" means, in the case of gold, a fine troy ounce, and in the case of silver, platinum and palladium, a troy ounce.
Call Options	An agreement that gives an investor the right (but not the obligation) to buy a stock, bond, commodity, or other instrument at a specified price within a specific time period.
Collar Transaction	A collar is a combination of a cap and a floor where one party is the floating rate or floating commodity price payer on the cap and the other party is the floating rate or floating commodity price payer on the floor.

[1] International Swaps and Derivates Association. Accessed at: http://www.isda.org/educat/pdf/documentation_of_derivatives.pdf on 15/10/2010.

Commodity	A basic good used in commerce that is interchangeable with other commodities of the same type. Commodities are most often used as inputs in the production of other goods or services. The quality of a given commodity may differ slightly, but it is essentially uniform across producers. When they are traded on an exchange, commodities must also meet specified minimum standards, also known as a basis grade.
Commodity Option	Commodity Option. A transaction in which one party grants to the other party (in consideration for a premium payment) the right, but not the obligation, to purchase (in the case of a call) or sell (in the case of a put) a specified quantity of a commodity at a specified strike price. The option can be settled either by physically delivering the quantity of the commodity in exchange for the strike price or by cash settling the option, in which case the seller of the option would pay to the buyer the difference between the market price of that quantity of the commodity on the exercise date and the strike price.
Commodity Swap	A transaction in which one party pays periodic amounts of a given currency based on a fixed price and the other party pays periodic amounts of the same currency based on the price of a commodity, such as natural gas or gold, or a futures contract on a commodity (*e.g.,* WTI Oil on the New York Mercantile Exchange); all calculations are based on a notional quantity of the commodity.
Currency Option	A transaction in which one party grants to the other party (in consideration for a premium payment) the right, but not the obligation, to purchase (in the case of a call) or sell (in the case of a put) a specified amount of a given currency at a specified strike price.
Derivative	A security whose price is dependent upon or derived from one or more underlying assets. The derivative itself is merely a contract between two or more parties. Its value is determined by fluctuations in the underlying asset. The most common underlying assets include stocks,

	bonds, commodities, currencies, interest rates and market indexes.
Equity	A stock or any other security representing an ownership interest
Equity Option	A transaction in which one party grants to the other party (in consideration for a premium payment) the right, but not the obligation, to purchase (in the case of a call) or sell (in the case of a put) shares of an issuer or a basket of shares of several issuers at a specified strike price. The option may be settled by physical delivery of the shares in exchange for the strike price or may be cash settled based on the difference between the market price of the shares on the exercise date and the strike price.
Foreign exchange transaction	A transaction providing for the purchase of one currency with another currency providing for settlement either on a "spot" or two-day basis or a specified future date.
Forward rate agreement (Interest Rate forward)	A forward contract between two parties to exchange an interest rate differential on a notional principal amount at a given future date in which one party, the Long, agrees to pay a fixed interest payment at a quoted contract rate and receive a floating interest payment at a reference rate (underlying rate) determined at expiration day (maturity).
Futures	A financial contract obligating the buyer to purchase an asset (or the seller to sell an asset), such as a physical commodity or a financial instrument, at a predetermined future date and price.
Hedging	Making an investment to reduce the risk of adverse price movements in an asset. Normally, a hedge consists of taking an offsetting position in a related security, such as a futures contract.
Interest rate Option	A transaction in which one party grants to the other party (in consideration for a premium payment) the right, but not the obligation, to receive a payment equal to the amount by which an interest rate either exceeds (in the case of a call option) or is less than (in the case of a put

	option) a specified strike rate.
Interest Rate Swap	A transaction in which one party pays periodic amounts of a given currency based on a specified fixed rate and the other party pays periodic amounts of the same currency based on a specified floating rate that is reset periodically, such as the London inter-bank offered rate; all calculations are based on a notional amount of the given currency.
Leverage	The amount of debt used to finance a firm's assets. A firm with significantly more debt than equity is considered to be highly leveraged.
Liquidity	The degree to which an asset or security can be bought or sold in the market without affecting the asset's price. Liquidity is characterized by a high level of trading activity. Assets that can be easily bought or sold are known as liquid assets.
Option	An option represents the right but not the obligation to purchase or sell a unit of an underlying asset at a pre-agreed price in exchange for an upfront premium payment/receipt.
Physical Commodity Transaction	A transaction which provides for the purchase of an amount of a commodity, such as coal, electricity or gas, at a fixed or floating price for actual delivery on one or more dates.
Put Option	An option contract giving the owner the right, but not the obligation, to sell a specified amount of an underlying security at a specified price within a specified time.
Spot Price	The price of a commodity, security or currency that is quoted for immediate payment and delivery.
Swap	Traditionally, the exchange of one security for another to change the maturity (bonds), quality of issues (stocks or bonds), or because investment objectives have changed. Recently, swaps have grown to include currency swaps and interest rate swaps.

Tobin's Q	Economics theory of investment behavior where 'q' represents the ratio of the market value of a firm's existing shares (share capital) to the replacement costs of the firm's physical assets (thus replacement cost of the share capital). It states that if q (representing equilibrium) is greater than one (q>1), additional investment in the firm would make sense because the profits generated would exceed the cost of the firm's assets. If q is less than one (q<1), the firm would be better off selling its assets instead of trying to put them to use. The ideal state is where q is approximately equal to one denoting that the firm is in equilibrium. The theory was proposed by US Nobel laureate economist James Tobin. .[2]
Vanilla Option	A normal option with no special or unusual features.

[2]Accessed at: http://www.businessdictionary.com/definition/Tobin-s-q-theory.html on 15/12/2010.

List of Abbreviations:

Abbreviation	Definition
&	And
ASX	Australian Stock Exchange
AUS	Australia
AUS$	Australian Dollars
CEO	Chief Executive Officer
CBOT	Chicago Board of Trade
CM	Commodity
CME	Chicago Mercantile Exchange
Forex	Foreign Exchange
FX	Foreign Exchange
GBP	United Kingdom Pound
IR	Interest Rates
Jibar	Johannesburg Inter-bank Agreed Rate
JSE	Johannesburg Securities Exchange
Libor	London Inter-bank Offer Rate
MERC	Mercantile Exchange
OTC	Over-the-counter
RSA	Republic of South Africa

SA	South Africa
Trillion	One-thousand-billion
TSX	Toronto Stock Exchange
UK	United Kingdom
USA	United States of America
US$	USA Dollars

Table of Contents

Chapter 1: Introduction

Introduction

This study analyses derivative usage in the mining sector, by comparing listed South African, Australian and United Kingdom mining corporations. The research investigates whether significant differences exist between the sovereign entities. The study further examines whether such differences are as a result of size differences, specific mining industry sector differences, or are as a result of specific derivatives being utilised more regularly in a specific region of the world[3]. In terms of size differences and specific derivatives being used more regularly in a specific region of the world, the focus will apply mainly to South African and Australian listed entities.

Quantitative analysis techniques were applied to the data collected, in order to provide detailed representations of the statistics, and to generate conclusions. Data that emerged from qualitative interviews conducted with South African industry experts were analysed, and themes developed, to produce a composite understanding of the topic, and to corroborate and interpret the quantitative findings.

In this chapter a definition of a derivative is given, followed by a description of the historical background, to set the context for the study. Thereafter follows a brief exposition of the various types of derivative contracts and the potential benefits to be achieved by their use in the mining industry. The rationale for the study and the research objectives are then discussed, before the critical research questions, which are the central focus of the research, are set out. Finally, the limitations of the study are reviewed and an overview of the thesis is provided.

1.1 Derivative definition

"A derivative is a risk transfer agreement, the value of which is derived from the value of some underlying asset. The underlying asset could be an interest rate, a physical commodity, a

[3] The inclusion of UK listed mining companies predominantly facilitates the inclusion of larger GAAP compliant entities with significant mining operations in the world, including South African and Australian operations into the study. The UK is not considered a centre of mining per se. This will however be explained later in the study.

company's equity shares, an equity index, a currency, or virtually any other tradable instrument upon which parties can agree."[4]

1.2 Historical Background

In this section, the history of derivatives is described, including a discussion on how derivatives are used in the mining sector and the reasons for using derivatives in this sector.

Documented evidence of derivative transactions dates back to 4000BC in Mesopotamia. Weber (2008) elaborates on the fact that derivative contracts emerged as soon as humans were able to make credible promises. In commercial environments, it is essential that a credible promise is recorded. Hence, it is logical that the invention of writing in the form of cuneiform script on clay tablets coincided with the first known derivative – a contract for future delivery.

Swan (2000) expounds on the correlation between the ascendancy of Greek civilization, beginning around 1000 BC, and the earliest recorded contracts for future delivery. This, in Swan's (2000) opinion, is primarily related to the Athens's dependence on sea-borne trade, and more specifically the prevalence of grain imports from Egypt.

After the fall of the Roman Empire, derivatives continued to be used by the Byzantine Empire in the eastern Mediterranean (Weber, 2008). Nothing more is heard of derivatives during the Dark Ages, until derivative trading on securities was observed again in the post Renaissance period. The spread of derivatives took place from Amsterdam to England and France between the 17th and 18th century, and finally from France to Germany in the early nineteenth century. (Weber, 2008)

The establishment of the Chicago Board of Trade in 1848 in the United States of America (US) served to satisfy US farmers' needs to avoid the risk of price fluctuation, and in turn those of their bankers. The futures market set a price for grain for the delivery of a standardised grade, at a later delivery date (Poitras, 2006).

These futures markets also served as a means to "hedge", as well as to speculate on price changes. Farmers and traders alike soon concluded that the sale and delivery of the grain itself was not nearly

[4] International Swaps and Derivative Association(ISDA). Accessed at: www.isda.org/educat/faqs.html

as important as the ability to transfer the price risk associated with the grain (Chance, 1998). Elsewhere in the world, similar markets were established. In Japan, for example, the Dojima Rice Exchange, first established in 1697, was originally a market for rice bartering, which developed into a fully fledged commodity futures exchange, eventually dissolving in 1939.[5]

The next major catalyst contributing to the development of derivatives popularity, according to Chance (1998), occurred in the 1980s. It was the 1980's generation of corporate financial managers who were the first to emerge from business school with exposure to derivatives. The 1980s also saw the introduction of formal exchanges, technology and marking to market to deal with credit risk. Widespread derivative usage increased dramatically as large and small corporations alike, began to hedge and speculate on everything from interest rate, exchange rate and commodity risk.

In 1983, the Chicago Board Options Exchange (CBOE) saw the introduction of options on broad-based stock indexes. The CBOE launched the CBOE-100 Index, which was later renamed the Standard and Poor's 100 Index(S&P 100 Index), and on July 1, 1983, options trading on the S&P 500 Index was launched. [6]

Throughout the 20th and 21st centuries several derivative disasters have enjoyed notoriety in the press. This has been the primary exposure that the public has had to the relatively hidden world of derivatives. In 1994 Metallgesellshaft lost $1.9 billion as a result of oil futures.[7] Barings Bank, at the hand of rogue Singapore trader Nick Leeson, lost $1.4 billion in 1995 as a result of Nikkei 225 index derivatives[6]. In 1998, Long Term Credit Management, the Nobel laureate-run hedge fund was extricated from potential disaster at a cost of $3.6 billion, out of fears of worldwide financial collapse[8]. In 2001, Enron, the seventh largest company in the US, and the world's largest energy trader went insolvent after extensive use of energy and credit derivatives.[9] The year 2008 marked yet another significant year for derivatives: Jerome Kerviel, a Société Générale trader, lost €4.9

[5] Accessed at: http://www.investopedia.com/terms/d/dojima-rice-exchange.asp on 7/12/2010.
[6] Chicago Board of Options Exchange. Accessed at: http://www.cboe.com/aboutcboe/History.aspx on 11/12/2010.
[7] Derivatives Debacles- Case Studies of Large Losses in Derivatives Markets. Accessed at: http://fir.nes.ru/~agoriaev/Papers/Kuprianov%20Case%20studies%20of%20large%20losses%20in%20derivative%20markets%20EQ95.pdf on 17/12/2010.
[8] Derivatives Strategy Magazine. Accessed at: http://www.derivativesstrategy.com/magazine/archive/1999/0499fea1.asp on 3/12/2010.
[9] New York Times. Accessed at: http://www.nytimes.com/2001/11/29/business/enron-s-collapse-the-derivatives-market-that-deals-in-risks-faces-a-novel-one.html?pagewanted=2 on 2/12/2010.

billion in purportedly unauthorised futures trading.[10] Most recently however, 2009 saw a $180 billion government-funded bailout of insurer AIG to prevent the world's financing system from imploding.[11] This was primarily as a result of AIG's Credit default swaps (CDS) and derivative exposure.[12] Fears of a widespread system collapse mounted as a result of the web of poorly-understood CDS bets and counter-bets among the world's largest banks, investment funds, and insurance companies.

Having briefly summarised the historical development of derivatives, I shall now proceed to examine derivative trading as it applies to mining companies.

1.3 Derivative trading in mining companies:

There exist two distinct groups of derivative contracts, which are distinguished by the way they are traded in the market:

Over-the-counter (OTC) derivatives are defined by the International Swaps and Derivative Association (ISDA) as customized, bilateral agreements that transfer risk from one party to the other[13]. OTC derivatives, which are sometimes called swap agreements or swaps, are negotiated privately between the two parties and then booked directly with each other. The ISDA list five fundamental differences between over the counter derivatives and exchange traded derivatives[13]. The ISDA refer to futures for exchange traded derivatives and swaps for over-the-counter derivatives. Firstly, the terms of a futures contract—including delivery places and dates, volume, technical specifications, and trading and credit procedures, whilst standardised for futures are subject to negotiation for an OTC derivative such as a swap. Futures contracts are always traded on an exchange, while swaps are traded on a bilateral basis. Third, those who engage in futures transactions assume exposure to default by the exchange's clearinghouse; for OTC derivatives, the exposure is to default by the counterparty. Fourth, credit risk mitigation measures, such as regular mark-to-market and margining, are automatically required for futures but optional for swaps. Finally, futures are generally subject to a single regulatory regime in one jurisdiction, while swaps—

[10] Worldwide legal directories. Accessed at: http://www.hg.org/article.asp?id=6028 on 12/12/2010.
[11] Harvard Law School Forum. http://blogs.law.harvard.edu/corpgov/2009/07/21/how-deregulating-derivatives-led-to-disaster/ on 2/12/2010.
[12] Reuters. Accessed at: http://www.reuters.com/article/idUSMAR85972720080918 on 13/12/2010.
[13] International Swaps and Derivatives Association. Accessed as: www.isda.org/educat/faqs.html on 9/12/2010.

although usually transacted by regulated firms—are transacted across jurisdictional boundaries and are primarily governed by the contractual relations between the parties.

The OTC derivative market is the largest market for derivatives, and is largely unregulated with respect to disclosure of information between the parties. Forward contracting is restricted to the significant spot market participants (the mining companies), the largest banks, and financial institutions, including hedge funds (Poitras, 2006).

According to the Bank for International Settlements, the total outstanding notional amount invested in over the counter derivatives is US$ 582 trillion, as of June 2010.[14] This notional amount comprises: 9% foreign exchange contracts, 77.9% interest rate contracts, 0.5% commodity contracts, 1% equity contracts, 5.1% credit default swaps and 6.5% other.

Exchange-traded derivative contracts (ETD) are those derivatives instruments that are traded via specialised derivative exchanges or other exchanges. Exchange-traded derivatives do not form a significant portion of derivatives traded by mining corporations, and hence they do not form a focus of this study. As at June 2010, a total outstanding notional amount of $32.4 billion was in the form of exchange-traded derivatives- a far smaller market than the OTC market.[15]

In reality, exchange-traded currency forwards are an insignificant fraction of total trading volume in the global currency market (Poitras, 2006). Direct trading in forward contracts is restricted to the significant spot market participants, effectively the largest banks and financial institutions (Poitras, 2006).

1.4 Derivative benefits to mining companies:

Derivatives have three uses particularly relevant in their application to mining entities: risk management that reduces return volatility is frequently termed “hedging”, and risk management that increases return volatility is called speculation (Hentschel et al, 2001). In addition, optionality is a further potential benefit of derivative usage.

[14] Bank for International Settlements. Accessed at: http://www.bis.org/statistics/derstats.htm on 15/12/2010.
[15] Bank for International Settlements. Accessed as: http://www.bis.org/publ/qtrpdf/r_qa1012.pdf#page=126 on 15/12/2010.

1.4.1 **Hedging** - is the primary purported purpose for derivative usage by mining entities. By entering into a derivative contract whose value moves in the opposite direction to their underlying position, the mining company cancels part or all of its potential risk, e.g., if I can agree with the counter-party to buy my gold at $1300/oz and the price per oz drops to $1000/oz, I have hedged the price risk inherent in my underlying commodity, thus locking in my profit margin and mitigating my risk that the market will turn against me[16].

1.4.2 **Speculation**- Mining companies have the potential to profit if they believe the value of their underlying asset will move in an expected direction. For example, if I expect the gold price to fall and hence sell forward much more gold than I can produce in time for the forward sale - this is speculation as I will be required to buy spot at the time to deliver into the forward contract. This is particularly relevant in the mining industry as many miners are enticed by the potential substantial financial rewards if they can correctly predict the direction of their underlying commodity, e.g. If the prevailing market price for gold is $1300/oz, but I believe the market price will decrease to $1000/oz, I can enter into a forward contract with a counterparty which would compel them to purchase an pre-agreed quantity of gold from me that I do not have on hand at the pre-agreed $1300/oz. When the contracted time for delivery arrives, I will then go to the market, buy the pre-agreed gold at the market prevailing $1000/oz and sell to the counterparty at the pre-agreed $1300/oz and hence lock in a profit.

1.4.3 **Optionality**- if the value of the derivative is linked to a specific condition or event, I can create a potential deal that I can exercise at my will. This is a true hedge as it does not come with production risk e.g. if as a miner, I buy a "put" option on gold at $1300/oz, I can, at my option, compel the counterparty to buy gold from me at the pre-agreed price of $1300/oz, this, in spite of the market price of gold having dropped to $1000/oz. Furthermore, in spite of having the right to sell at $1300/oz, I can elect to not produce the underlying commodity and not to exercise the option, hence the increased flexibility associated with option usage.

[16] Price risk is reduced only if one is able to meet the production targets required to deliver into the contract. As a miner, one takes on production risk. Hopefully - this is under greater control. If you cannot produce the contracted amounts then the hedge creates price risk as you need to buy spot at the time to deliver in terms of the forward contract. This problem does not exist with options.

1.5 Rationale and research objectives

Many studies have been conducted in the past regarding derivatives usage by companies across many countries, industries and sectors. There has, to the best of my knowledge, been a notable silence on studies related to derivative usage in the mining sector, including inter-country comparisons.

The methodology employed in research studies thus far has been predominantly conducted through the use of surveys. Researchers have tended to use some derivation of the Wharton Survey of derivative usage originally put forward by Bodnar et al, in their 1995 paper entitled "Wharton Survey of Derivatives Usage by U.S. Non-Financial Firms" (Bodnar et al, 1995).

This study aims to critically analyse derivative usage across the mining sector, comparing mining-intensive markets, comprising South Africa, Australia and the United Kingdom. The study attempts to draw conclusions ranging from countrywide derivative usage rates to most common derivative types used, and then I will draw comparisons from the qualitative interview data, which emerged from discussions with individuals personally involved in the mining sector.

IFRS Disclosure Requirements:

International Financial Reporting Standards (IFRS) require IFRS compliant firms using derivatives and other financial instruments to disclose these instruments and their respective fair values in their financial statements. Depending on the particular type of financial instrument, qualitative and or quantitative disclosure of the instrument is required. It is these particular disclosure requirements that facilitates an investigation into the derivative usage in the mining sector. Prior to the introduction of IFRS7 Financial Instruments: Disclosures, on 2005 on 1 January 2007 and IAS 32: Financial Instruments: Presentation, initially on 1 January 1996, revised by IAS39: Recognition and Measurement of Financial instruments and then effective on 1 January 2001, derivative studies were largely conducted by virtue of surveys conducted by researchers and completed by obliging financial managers. As such, the information was neither audited nor was the information obtained entirely reliable and unbiased. Whilst the financial reporting, measurement requirements and disclosure requirements for accounting of derivatives is certainly debatable, the mandatory disclosure requirements somewhat aid and facilitate studies into derivative usage.

Overview of IFRS 7

According to Deloitte's IASPlus.com, IFRS 7 is the IFRS standard that puts all of the financial instruments disclosures together in a new standard called *Financial Instruments: Disclosures*. IAS 32 Disclosure provisions were in fact superseded by IFRS 7 effective 2007. According to IFRS7, certain disclosures are to be presented by category of instrument based on the IAS 39 measurement categories. The two main categories of disclosures required by IFRS 7 are:

1. Information about the significance of financial instruments.
2. information about the nature and extent of risks arising from financial instruments

Information about the significance of financial instruments relevant to the study[17]:

Balance Sheet

- Disclose the significance of financial instruments for an entity's financial position and performance. [IFRS 7.7] This includes disclosures for each of the following categories: [IFRS 7.8]
    - financial assets measured at fair value through profit and loss, showing separately those held for trading and those designated at initial recognition
    - financial liabilities at fair value through profit and loss, showing separately those held for trading and those designated at initial recognition
- Other balance sheet-related disclosures:
    - special disclosures about financial assets and financial liabilities designated to be measured at fair value through profit and loss, including disclosures about credit risk and market risk, changes in fair values attributable to these risks and the methods of measurement.[IFRS 7.9-11]

Income Statement and Equity disclosures relevant to the study:

- Items of income, expense, gains, and losses, with separate disclosure of gains and losses from: [IFRS 7.20(a)]

[17] IASPlus.com- IFRS 7 Summary. Accessed at: http://www.iasplus.com/standard/ifrs07.htm on 1/12/2010.

    - financial assets measured at fair value through profit and loss, showing separately those held for trading and those designated at initial recognition.
    - financial liabilities measured at fair value through profit and loss, showing separately those held for trading and those designated at initial recognition.
- Other income statement-related disclosures:
    - amount of impairment losses by class of financial assets [IFRS 7.20(e)]
    - interest income on impaired financial assets [IFRS 7.20(d)]

Other Disclosures

- accounting policies for financial instruments [IFRS 7.21]
- information about hedge accounting, including: [IFRS 7.22]
    - description of each hedge, hedging instrument, and fair values of those instruments, and nature of risks being hedged
    - for cash flow hedges, the periods in which the cash flows are expected to occur, when they are expected to enter into the determination of profit or loss, and a description of any forecast transaction for which hedge accounting had previously been used but which is no longer expected to occur
    - if a gain or loss on a hedging instrument in a cash flow hedge has been recognised in other comprehensive income, an entity should disclose the following: [IAS 7.23]
- for fair value hedges, information about the fair value changes of the hedging instrument and the hedged item [IFRS 7.24(a)]
- information about the fair values of each class of financial asset and financial liability, along with: [IFRS 7.25-30]
    - comparable carrying amounts
    - description of how fair value was determined
    - the level of inputs used in determining fair value
    - reconciliations of movements between levels of fair value measurement hierarchy
    - information if fair value cannot be reliably measured

Nature and extent of exposure to risks arising from financial instruments relevant to the study:

Qualitative disclosures [IFRS 7.33]

- The qualitative disclosures describe:
    - risk exposures for each type of financial instrument
    - management's objectives, policies, and processes for managing those risks
    - changes from the prior period

Overview of IAS39:

Whereas IFRS7 deals primarily with disclosure requirements, IAS39 deals primarily with financial instrument recognition and measurement in the annual financial statements of IFRS compliant firms. Given the complexity of IAS39, the summary below merely serves to provide a brief skeleton of the relevant requirements of IAS39 as they relate to derivatives in a company's annual financial statements.

IAS39: Recognition and Measurement of Financial Instruments

Scope exclusions relevant to the study[18]:

IAS 39 applies to all types of financial instruments except for the following, which are scoped out of IAS 39: [IAS 39.2]:

Contracts to buy or sell non-financial items

Contracts to buy or sell non-financial items are within the scope of IAS 39 if they can be settled net in cash or another financial asset and are not entered into and held for the purpose of the receipt or delivery of a non-financial item in accordance with the entity's expected purchase, sale, or usage requirements. Contracts to buy or sell non-financial items are inside the scope if net settlement occurs. The following situations constitute net settlement: [IAS 39.5-6]

- the terms of the contract permit either counterparty to settle net
- there is a past practice of net settling similar contracts

[18] IASPlus.com – IAS39 Summary. Accessed at: http://www.iasplus.com/standard/ias39.htm on 1/12/2010.

- there is a past practice, for similar contracts, of taking delivery of the underlying and selling it within a short period after delivery to generate a profit from short-term fluctuations in price, or from a dealer's margin, or
- the non-financial item is readily convertible to cash

Fundamental Exclusion of IAS39

It is specifically IAS39.5-6 that scopes forward sales of a mine's commodities e.g. forward sales of gold for a gold mine, out of the ambit of IAS39. As such IFRS does not require quantitative disclosure for mining companies when they make forward sales of their commodities. Same would not apply to a financial institution such as an investment bank buying and selling forward contracts on gold for speculative purposes without the possibility of physical delivery of the underlying.

IFRS Implications for the study

As discussed above, IFRS derivative disclosure requirements are by no means foolproof in terms of facilitating studies of derivative usage. Furthermore there has been virulent debate as to whether IFRS mandated marking to market played a role in the financial crisis. Nevertheless IFRS7 has indeed facilitated a greater understanding of a company and more specifically a mine's financial commitments from a shareholders perspective. It is specifically IFRS7 that enables a shareholder of a company to assess the income, expense, gains, and losses associated with derivatives. Furthermore one can analyse the amount of impairment losses by class of financial assets as well as assess the accounting policies for financial instruments, information about hedge accounting, including a description of each hedge, hedging instrument, and fair values of those instruments, and nature of risks being hedged along with comparable carrying amounts, description of how fair value was determined. Such mandated inclusions are fundamental to research of this nature.

1.6 Research questions

The study seeks to answer the following questions:

1. To what extent are derivatives used by firms in the mining sector in South Africa, Australia and the United Kingdom?
2. What are the similarities or differences between derivative usage in mining companies in South Africa, Australia and the United Kingdom?

3. What risks are most often hedged by mining companies?
4. What is the effect of firm size and derivatives usage in the mining sector?
5. What is the effect of industry differentiation on derivative usage in the mining sector?

1.7 Limitations of the study

Certain limitations arise during a research paper of this nature. Primarily, the study focuses on a static piece of data consisting of one year of financial year end reports. For classification purposes, the year end of the companies concerned ranged from 31 March 2009 to the 31 March 2010. For said purposes, any company year-end falling within this timeframe shall be considered to be the 2009 year of assessment. The study was further limited to listed companies only; this, in spite of there being many unlisted mining companies.

Given the multiplicity of OTC and ETD derivatives in existence, the study was limited in its scope to looking only at commodity forwards, commodity options, currency forwards, currency options, interest rate forwards, as well as interest rate swaps. The exclusion of equity derivatives appears reasonable in light of the results from the International Swaps and Derivatives Association Derivative Usage Survey [19] conducted in 2009. In the survey, only 30.3% of firms used equity derivatives versus some 50.9%, 93.6% and 88.3% for commodity, foreign exchange and interest rate derivatives respectively.

In terms of data collection, the data set for the South African market includes all of the RSA listed mining companies as at 31 December 2009. In contrast, the data set for the Australian population comprises a sample of the top 100 companies, ranked by market capitalisation, which makes up some 96.4% of the total market capitalisation of the AUS mining market as a whole. For the United Kingdom, the data set comprised a sample of the top 100 ranked mining companies by market capitalisation, which makes up some 99.2% of the UK mining market as a whole.

In terms of data collection, IFRS7 specifically excludes executable contracts; as such, I have relied on optional qualitative and quantitative disclosure of such executable contracts. I am however

[19] International Swaps and Derivative Association Usage Survey. Available: http://www.isda.org/researchnotes/pdf/ISDA-Research-Notes2.pdf. Accessed on 12/12/2010.

limited in analytical ability for the aforesaid reason. Furthermore, firms absent of any formalised derivative disclosure or derivative mention in the 2009 year end financials or the prior year financials have been classified as “non users.”

Finally, statistical conclusions may be limited by the inability to draw relationships at a comparative level between countries, size categories and mining subsectors, this primarily as a result of insufficient sample sizes within the respective categories.

1.8 Concluding Remarks

The above chapter has introduced the focus and purpose of the study, as well as identified the critical questions to be answered. It has established the historical background for the use of derivatives and explained the types of derivative contracts and the potential benefits of their use in the mining industry. In the next chapter, the existing literature relating to derivative usage will be reviewed. Chapter 3 will deal with research methodology of both the quantitative and qualitative data. Chapter 4 will present the graphical and statistical results of the quantitative data. Chapter 5 will give an overview of the themes and ideas that emerged from the qualitative interviews. Finally Chapter 6 will conclude on the substantial findings of the study, taking into account an overall view of both the qualitative and quantitative data.

Chapter 2: Literature Review

2. Introduction

This chapter will examine the main issues arising from published studies related to the use of derivatives by listed firms operating in all sectors and in the mining sector in particular. The focus will be on derivative use of companies listed in South Africa, Australia and the United Kingdom. It will also consider those elements that influence the extent of the usage, the different instruments used by the firms, as well as the risks hedged using the derivatives. This review of the existing literature relating to derivatives usage by various industries worldwide provides a background to the quantitative and the qualitative aspects of the study.

The section of the study will commence with a review of the existing research on the use of derivatives as a tool for value creation, hedging instruments, as a risk management tool, as well as, as a speculative instrument for corporate profit- making. The chapter will further cover an analysis of the extent to which derivatives are used in the mining sector across three regions: South Africa, Australia and the United Kingdom. A review of the literature detailing the extent of derivatives usage by firms in the mining sector in South Africa, Australia as well as the United Kingdom will follow. This will then lead on to prior findings detailing whether firm size affects the use of derivatives. An assessment of risks most often hedged by companies both in and out of the mining sector will be discussed. Finally the chapter will conclude with a review of the various derivative securities most often used by companies.

2.1 Previous research in the field:

The theory covering derivatives usage as a risk management tool is extensive and widespread. There are three principal determinants required to justify risk management activities (derivative usage): reducing financial distress, increasing investment opportunities and reducing expected tax payments (Tufano, 1996). Each of the three aforementioned tools has one common theme - value creation.

The value-creating premise is proposed by Smith and Stulz (1985), who show that a leveraged company that hedges can lower expected bankruptcy costs and increase company value. Shapiro & Titman (1986) suggest that a company can lower costs in a number of indirect ways by hedging. Specifically, if hedging lowers the probability of financial distress, then risk-averse stakeholders (such as employees, suppliers and customers) will require a lower risk premium for contracting with the company. These savings increase company value.

Froot et al (1993) suggest a different argument for value creation. Their argument relates to external financing costs. Reducing exposure to financial risks, by using derivatives, may increase shareholder value by harmonising financial and investment decisions.

On a somewhat different note, Ross (1997) & Leland (1998) show that by hedging, companies can increase debt capacity, and in this way increase company value. Similar to Tufano (1996), Berkman et al (1997) found that in all of the New Zealand firms surveyed in their derivative study, justifications stated for derivative usage related to reducing the volatility of earnings and cash flows, which in turn would lead to increases in firm value.

An interesting proposal suggested by Brown (1999) stated that if foreign currency hedging allowed a company to follow its optimal investment policy more closely, then this should increase the company's value. Minton & Schrand (1999) endorsed the principle initially suggested by Tufano (1996), that on average, companies with lower volatility (as a result of derivatives usage) over a period, have higher levels of investment over the same period. Higher levels of investment will in turn lead to value creation.

Shin and Stulz (2000) found that there is a negative relation between cash flow volatility and shareholder wealth. The significance of the finding was compounded by the stronger results found for firms that were financially weak and had poorer growth opportunities. More directly, Allayannis & Weston (2001) in their study found a positive relationship between firm value and the use of foreign currency derivatives. It is evident that there is significant support for the premise that derivatives can indeed create value for corporations.

Furthermore, Allaynnis & Weston (2001) found that firms that begin a hedging policy, experience an increase in value of approximately 5% above those firms that choose to remain unhedged. Firms that desist from hedging experience a decrease in value relative to those firms that choose to remain hedged.

According to Dionne & Triki (2003), the reason that firms pay great attention to the way in which they manage risk is because it affects their value. One can conclude that whether Dionne & Triki (2003) are implying preventing value destruction or value creation, their view suggests that value enhancing characteristics of derivatives exist.

A very different view on value creation is suggested by Bartram (2003), who states that risk management at the firm level, as opposed to risk management by shareholder, represents a means to increase firm value to shareholders.

A second proposition expressed by Bartram (2003) states that corporate hedging can increase shareholder value through the reduction of transaction costs. By lowering the likelihood of bankruptcy, the expected cost of financial distress is reduced and the debt capacity is increased.

A view put forward by theorists in favour of derivative usage suggests smoothing accounting earnings, through the use of derivatives, leads to value creation. This view is supported by Allayannis & Weston (2003) who put forward the view that a manager's efforts to produce smooth financial statements do in fact add value to the firm, an idea that is consistent with risk management theory. This theory is however flawed by virtue of the fact that according to IAS39, derivatives are required to be marked to market at their fair value; hence the premise of smoothing accounting earnings does not seem plausible.

Guay and Kothari (2003) conducted a study of derivatives usage by large US corporations, examining the amount of financial exposure managed via derivatives. Their findings suggest that the cash flow generated from derivatives is relatively small in comparison to economic exposure and operating cash flows. Therefore, they argue that an increase in firm value is not driven by derivative instruments. According to these authors, derivatives are merely a "noise proxy" for risk management.

Derivatives can be used to increase shareholder value by coordinating the need for and availability of internal funds. Thus, risk management can reduce underinvestment costs by reducing the volatility of earnings and consequently firm value, according to Benson & Oliver (2004).

Bartram, Brown & Fehle (2004) in their study investigating interest rate and foreign currency derivatives for 7292 companies in the US and 47 other countries over the period 2000-2001, found that the use of derivatives is associated with higher firm value; furthermore, the association is more significant for interest rates than forex. This suggests that firms should in theory have more interest rate swaps and forward rate agreements than currency forwards and options respectively.

However, Josef (2006) found that it is the perceptions held by investors and shareholders, with regards to the use of financial derivatives, which are a significant motivator behind derivative usage. Companies do not want to be perceived as not taking full advantage of upswings in commodity markets by

remaining hedged, whilst at the same time, firms feel they are expected to manage financial risk more carefully, by engaging in hedging.

According to Smithson and Simkins (2005) in their Morgan Stanley publication, subsequently published in the Journal of Applied Corporate Finance- a number of studies reviewed showed a clearly positive correlation between higher share values and the use of derivatives to manage foreign exchange rate risk and interest rate risk. Furthermore, only one study provided fairly compelling evidence that the use of commodity price derivatives by commodity users actually increases share values. Carter, Rogers, and Simkins (2005) found that fuel price hedging by airlines was associated with significantly higher firm values. The study examined 29 U.S. airlines over the period 1992-2003 and found that firstly, the stock prices of all the airlines were highly sensitive to fuel prices and secondly the prices of the airlines that hedged traded at a 12-16% premium over those that did not. All other studies of hedging by commodity producers provide no clear support for the argument that risk management adds value.

2.2 Use of derivatives in the mining sector

According to Brown (1999), the extent of a company's hedging depends on a variety of issues including accounting treatment, derivative market liquidity, foreign exchange volatility, exposure volatility, technical factors and recent hedging outcomes. Firms are likely to use financial instruments to a greater extent to hedge short-term exposure and rely on operational hedging more heavily to hedge long term exposure (Chowdhry & Howe, 1999).

There is however an argument put forward, that hedging is not a significant factor for most mining companies. In their study of 234 US non-financial firm derivatives usage, Guay & Kothari (2001) found that the median firm holds derivatives securities that even under very generous assumptions could hedge only 3% to 6% of their aggregate interest rate and currency exchange rate exposures. The magnitude of derivative positions taken by most firms is economically small in relation to their typical risk exposure.

There are certain events that can trigger increased usage of derivatives: for example, hedging by gold mining companies tends to be higher when firms need to invest, and lower when there is no need to invest (Dionne & Garand, 2003). This serves to corroborate Berkman et al's (1997) findings that derivatives are a useful tool to smooth cash flows for the corporation, particularly at times when the entity requires significant Capex outflows. Justification for this trend stems from the fact that large

upfront capital expenditure is often bank funded. Banks in turn require that the firm will hedge a part of its future production to ensure that the firm is able to repay its loans with interest.

Another argument suggests that the extent of derivative usage depends on the volatility of underlying commodity prices and not on company-specific events. According to Betts & Mamik (2006), increasing gold price volatility increases the optimal level of forward selling, whilst reducing the optimal present value of lifetime production. In periods of relatively low variation in gold prices, it is optimal to operate with low levels of hedging.

Arguably the most important paper dealing with commodity price risk and derivatives is that of Jin and Jorion (2005). The study focused on the hedging activities of 119 U.S. oil and gas producers from 1998-2001 and concluded that, while hedging reduced the firm's stock price sensitivity to oil and gas prices, it did not appear to increase value. According to Jin and Jorion (2005), one might even argue that investors take positions in oil producers precisely to gain exposure to oil prices. If so, an oil firm should not necessarily benefit from hedging oil price risk.

In Callahan's (2002) study a negative correlation was found between the extent of gold hedging and the performance of firm's stock price when he assessed the impact of gold hedging on 20 North American gold mining firms between 1996 and 2000. On a similar note, Lookman (2004) analysed exploration and production (E&P) firms that hedge commodity price risk. Lookman looked specifically at an unbalanced panel set of 125 firms consisting of 364 firm-year observations over the period 1992-1994 and again between 1999 and 2000. In the study it was found that for undiversified E&P firms where commodity price risk is a primary risk, hedging is in fact associated with lower firm value. For diversified firms with an E&P segment, hedging was associated with higher firm value. In aggregate however no association with hedging and firm value was detected.

Having reviewed the limited studies covering the use of derivatives in the mining industry, I will now analyse prior research findings relating to how company size impacts derivative usage.

2.3 Firm size and use of derivatives

The size of a firm and its relative derivative usage is a fundamental element being investigated in this study. Traditional thought on the subject suggests that transactional costs exhibit economies of scale. As such, large firms are expected to gain more from derivative use. This justification emanates from the

ability of larger firms to bear the higher costs, as well as the lower cost of setting up a derivative programme for risk management (Warner, 1977). This theory is highly plausible, given the significant manpower, monitoring needs and appropriate systems to account for marking to market requirement associated with a successful derivative programme. However, this is completely rejected by Nance et al (1993), who suggest that smaller firms are more likely to hedge than larger firms, because the direct costs of financial distress are less than proportional to the firm size. Traditionally smaller firms have found it more difficult to issue fixed income securities and participate in formal exchanges due to the required sophistication and systems requirements. Increasingly however banks are in fact enabling firms to participate on an OTC basis to undertake interest rate swaps and forward contracts.

Nance et al (1993) in their Fortune 500 study found supporting evidence that a firm is more likely to use derivatives if it is:

1. large in size;
2. highly leveraged;
3. has more growth opportunities;
4. has a higher dividend yield, but it less liquid.

Francis & Stephan (1993) suggested a completely different theory as to the reasons for larger firms to hedge. According to them, larger firms with many more shareholders, will tend to hedge, because their primary aims is to reduce scrutiny of variable earnings, by using derivatives to hedge accounting earnings. Hedging programmes require a sophisticated understanding of derivatives and appropriate risk management and accounting systems. Smaller firms are lacking in such systems and risk management. The same principle also applies to capital budgeting – whereby larger firms tend to use sophisticated methods such as Monte Carlo simulation and discounted cash flow methodology for project analysis whilst small firms tend to use the simplified payback period methodology. Furthermore, the positive relationship between a firm's size and derivative usage can be justified due to the fact that smaller firms will tend to have smaller foreign currency exposure as they will be more locally orientated in terms of their sales and procurement versus their larger multinational counterparts. In his 2006 UK study, El Masry (2006) also found that larger firms are more likely to use derivatives than medium and smaller firms.

Stulz (1996) and Dionne & Triki (2004) present a slightly modified argument: that risk management is an expensive activity. It is for this reason that small firms might not be able to afford to implement a

derivatives programme. Mian's (1996) findings support those of Warner (1977)**.** Mian found robust evidence that larger firms are more likely to hedge. Mian's evidence supports the hypothesis that there are economies of scale in hedging and that information and transaction considerations have more influence on hedging than the cost of raising capital.

Elements of Mian's (1996) view are supported by Geczy et al (1997) in their investigation of foreign currency derivatives usage by 372 Fortune 500 companies, which found supporting evidence that a firm is more likely to use derivatives if it is:

1. large in size;
2. experiencing growth opportunities, but it is not very liquid.

In other words, firms with greater growth opportunities but with tighter financial constraints are more likely to use derivatives because they want to minimize risks of fluctuations in profits.

Judge (2006) takes a view that larger firms and firms with more cash are more likely to hedge with derivatives. This aligns with the large majority of theories presented above.

In her South African study, Rothman (2001), focusing on the use of derivatives in non-financial companies, found that non-use of derivatives stemmed from high establishment costs, as well as maintenance costs associated with difficult pricing and valuing issues surrounding derivatives. These findings certainly support the findings of Stulz (1996) and Dionne & Triki (2004), that risk management is an expensive activity. As such, one can deduce that the higher cost would most likely be more punitive for smaller, as opposed to larger, corporations.

Size and leverage were both the main explanatory variables for derivative usage and were both positively related to derivative usage in the Bartram et al (2002) study. The study analyzed derivative usage in Australia covering some 158 Australian companies, including 52 mining firms. These findings are supported by El Masry (2006) in his UK study.

It is evident that there are a variety of conflicting views surrounding size effect on derivative usage. There are in essence two opposing schools of thought: the first view holds that derivative usage in large firms is not only more beneficial but is more prevalent. The opposing school suggests that due to the greater likelihood of financial distress, smaller firms are more likely to hedge. The former view is far more plausible and more widely supported. Derivative programmes are indeed costly, and as such, unaffordable for the average small firm. Smaller firms may desire to hedge but are not in fact able to do

so, one should not mix wishes with realities. However, there is undeniably merit in the argument that smaller firms in their establishment phase, under increased bank scrutiny, would seek to lock-in their cash flows at the expense of some upside. Banks may also not want small bank-financed firms to use derivatives to engage in speculation and therefore the banks will rely on risk management systems to ensure that speculation is less likely. I shall now proceed discuss the existing research on the primary risks hedged by companies.

2.4 Risks most often hedged by companies

There are three risks in total that the prior studies have identified: foreign exchange rate, interest rate as well as commodity price risk. The discussion of prior findings of the risks has been categorised into two groups: foreign exchange and interest rate risk, and commodity price risk. In terms of identifying risks most often hedged by companies, Aretz & Bartram (2009) noted a significant flaw in research papers that is particularly interesting to note. Most empirical studies classify firms as either 'hedgers' or 'non hedgers,' without allowing for the possibility that firms could move between the two groups over time. These important data and methodology issues suggest caution when interpreting historical empirical evidence, according to Aretz & Bartram (2009). The study will initially be identifying prior research findings addressing foreign exchange and interest rate hedging. The study will then proceed to discuss commodity price risk hedging.

2.4.1 Foreign Exchange and Interest Rate risk

Geczy et al (1997) found that users of currency derivatives are more likely to face import competition and that these hedgers are more likely to use short term dynamic hedging strategies instead of longer term strategies. There are however conflicting views across the different countries relating to currency hedging. In particular I will be contrasting the findings of US, South African and Swedish studies on the issue of foreign currency hedging.

Allayannis & Ihrig (1998) developed a model showing the competitive impact of foreign exchange exposures and tested the implication on a set of USA manufacturing companies. They show that companies in more competitive industries have an increased exposure to exchange rates. Corporations will engage in hedging only when both exchange rate uncertainty and demand uncertainty are present, according to Chowdhry & Howe (1999). These findings are particularly pertinent to mining corporations, given that their outputs are primarily export-driven.

According to Judge (2006), the degree to which a firm's cash flows are affected by exchange rate changes should depend on the nature of its activities, such as the level of export and import activity, its involvement in foreign operations, and the competitiveness of its input and output markets. In the mining industry, the effects of commodity prices and interest rate exposure can also affect a firm's cash flow. There is a clear linkage between exposure to exchange rate volatility as a result of importing and exporting and the need for foreign currency hedging[20].

In terms of value creation as a result of derivative usage, Allayannis & Weston (2001) in their study of the impact of foreign currency derivatives on 720 large non-financial firms over the period 1990-1995 found a positive relation between users of foreign currency derivatives and the firm's value. These findings are supported by Nain (2004), in his study of US firms covering both 548 derivative user and 2711 non-derivative users with ex-ante foreign currency exposure over the period 1997 to 1999, who found that foreign currency risk management increases firm value as measured by Tobin's Q, provided that many competitors hedge. Tobin's Q is essentially the ratio of a company's market value to its total asset value. (See definition in Chapter 1)

These findings were further corroborated by Kim, Mathur & Name (2004) in their 424 firm study covering the period 1996-2000, who found that financial risk management, and specifically foreign currency derivative usage is associated with higher firm value. Furthermore, Allayannis, Lel and Miller (2005) in their study of 379 foreign currency derivative firms covering the period 1990-1999 found that there exists a significant positive premium for users of derivatives with foreign currency exposures. The aforementioned study findings suggest that foreign currency hedging has a favourable effect on value creation for companies.

Rothman (2001), in her South African study, also researched the derivatives usage by non-financial South African firms. Her findings indicated that foreign exchange derivatives were most commonly used, followed by interest rate, commodity and equity derivatives respectively. These findings are supported by El Masry (2006) in his UK study, who found that foreign exchange is the most commonly managed risk with derivatives followed by interest rates risk.

In terms of interest rate risk, Rothman (2001) found that a high number of South African companies (23%) actively take interest rate positions in line with a market view on interest rates. In contrast, in a

[20] There may exist a natural hedge in place when it comes to economies dominated by mining- a stronger South African Rand is generally matched by higher commodity prices.

Swedish study, Alkeback et al (2006) found that every firm that used derivatives managed their foreign exchange exposure, whilst interest rate exposure was still confined to larger firms.

In their 2006 study, Correia, Holman and Jahreskog (2006) found that the overwhelming majority of South African firms used foreign exchange derivatives (74%); this was followed by interest rate derivatives (62%), then commodity derivatives (22%) and finally equity derivatives (8%). These results are in line with Bartram, Brown and Fehle (2009) in their study of the financial statements of 7319 non-financial firms in 50 countries including 58 South African companies who found that South African firms had a derivative usage rate of 89.9%. I shall now address findings relating to commodity price hedging and derivative usage.

2.4.2 Commodity Price risk

In terms of commodity price hedging and derivative usage, Bodnar, Hayt, Marston and Smithson (1995) indicate that the percentage of firms that use financial derivatives for hedging is the highest for firms that are classified as commodity-based, than for firms in any other classification.

In Callahan's (2002) study of 20 US Gold mining corporations, it was found that the more management hedges gold price risk with gold derivatives, the worse it is for the return of their firm's shares. Gold mining firms that aggressively hedge gold price risk are not maximising shareholder value. These findings are corroborated in a study covering 125 exploration and production firms that hedged commodity price risk over the period 1992-1994, as well as the period 1999-2000. Lookman (2004) found that for undiversified exploration and production firms, where commodity price risk is a primary risk, hedging is associated with lower firm value. In direct contrast, for diversified firms with an exploration and production segment, hedging is associated with higher firm value. In summary, no association with hedging and firm value was detected.

In their 2005 study, Jin and Jorion covered 119 US oil and gas producers over the period 1998-2001, and determined that risk management is not related to firm value. For oil and gas producers, the commodity risk exposure is easy to identify and easy to hedge by individual investors. Hedging by the firms does not confer a special advantage, since investors can hedge on their own, using futures traded on organized exchanges. As such, the oil and gas environment is closer to the Modigliani Miller irrelevance conditions (Jin & Jorion, 2004). Modigliani and Miller proved that in a world with perfect capital markets, risk management should be irrelevant; this, particularly because shareholders can undo

any risk management activities implemented by the firm at the same cost (Jin & Jorion, 2004). It is important to note that Modigliani and Miller's irrelevance conditions were premised on extreme assumptions- no information asymmetries, taxes, or transaction costs.

2.5 Types of derivates used by companies

I shall now briefly cover the prior literature about the particular derivatives relevant to this study in order to identify any prior findings.

El Masry (2006) found that in the UK, the most common instrument to hedge the exposures to foreign exchange risk, interest rate risk, commodity risk and equity risk are forwards (29%), this is followed by swaps, OTC options, futures, exchange traded options, structured derivatives and hybrid debt with usage rates at 23%, 17%, 13%, 8%, 6% and 2% respectively. In contrast, Howton & Perfect (1998) found that amongst US firms, swaps are the most often used interest rate contract, and forwards and futures the most often used currency contract. In line with these findings, Benson & Oliver (2004), in their Australian study found that forwards, options and swaps are the more common contracts that are used to hedge risk there. In addition, the main risks hedged are foreign currency and interest rate risks. I shall now address specific company characteristics that have been found to have had a dramatic impact on a company's derivative usage.

2.6 Company characteristics significant to derivative usage

A significant area of focus in this study deals with the question of whether there are in fact differences in derivative usage between countries. There is a strong argument to suggest that differences do not exist between countries per se, but rather between certain companies-specific characteristics. The fact that these company characteristics are more common to a particular country, results in what we perceive to be differences existing in relation to the use of derivatives across countries. Common company characteristics found to be of significance to derivative usage differences are:

1. highly leveraged firms
2. competitive industries.

2.6.1 Highly Leveraged firms:

Dolde (1996) suggests that highly leveraged firms are more likely to use derivatives to avoid the expected costs of financial distress. This may also imply that lenders require companies to hedge in order to repay the loan capital and interest. This finding is confirmed by Haushalter (2000), who found that companies with greater financial leverage manage price risk more extensively. This finding was further corroborated by Berkman et al (2002), who found that size and leverage are the main explanatory variables for derivative usage in the mining industry of Australia.

2.6.2. Competitive Industries

Froot et al (1993) suggest that hedging can be an important part of the optimal investment strategy of multinational corporations, particularly for companies facing product-market competition where investment is a "strategic substitute". Along the same line of thought, Mello, Parsons & Triantis (1995) and Chowdry & Howe (1999) show that a multinational company with international production flexibility is likely to implement a financial hedging programme as part of its optimal operating strategy. Short term hedging could allow for the stabilisation of margins and preservation of competitive standing simultaneously, while longer term competitive solutions are implemented. Similarly, Allayannis & Weston (1999) found that multinational companies in more competitive industries are more likely to use currency derivatives. Finally, El Masry (2006) found that derivative usage is greatest among multi-site firms and international firms. I shall now proceed to discuss specific findings across the US, New Zealand (NZ), Germany, Holland, Australia and the United Kingdom (UK) derivative studies.

2.7 Country Differences: Prior Research Findings

I will now discuss the literature covering derivative usage between countries. As part of the review, I will identify historically whether or not similarities and differences existed at a sovereign level.

In their 1997 derivative study comparing derivative usage between US and NZ companies, Berkman et al (1997) found that in spite of a less developed financial infrastructure and higher transaction costs, relatively, more New Zealand firms use derivatives. New Zealand is a small open economy compared to the USA which has a large internal market and in which many firms may not have exposure to exchange rate movements. That being said, the types of derivatives used to hedge were very similar.

Geczy et al (1997) showed that firms with greater growth opportunities and tighter financial constraints are more likely to use currency derivatives. Furthermore, firms with extensive foreign exchange rate exposure and economies of scale in hedging activities are more likely to use currency derivatives.

Significant similarities were found in the general patterns of usage across industry and firm size, between German and US firms. Determinants of derivative use are primarily driven by economic considerations, such as activities and firm's characteristics, and are not the result of corporate culture or other country specific differences, according to Bodnar & Gebhardt (1999). This is a highly debatable point, especially when one considers whether or not a country is considered to be an open economy. For example, Germany is the world's largest exporter; this is in sharp contrast to the USA with its huge internal economy.

Bodnar et al (2002) state that the primary reasons behind derivative usage relates to economic phenomena, rather than institutional differences. Dutch firms hedge more financial risk than US firms. US firms tend to focus more on accounting earnings than Dutch firms, and are more willing to incorporate their views on foreign exchange rate movements when engaging in derivative transactions (Bodnar et al, 2002).

Bartram, Brown and Fehle (2009) found that in 60.3% of companies in their study consisting of 7319 non-financial firms across 50 countries used derivatives to hedge risks. Furthermore, countries that did not have developed capital markets reported a lower level of derivative use. Malaysian firms for example had a derivative usage rate of 20%. Bartram et al (2009) further found that 64.3% of companies in OECD countries used derivatives whilst only 39.6% of companies in non-OECD countries used derivatives to hedge risks. According to Correia, Holman and Jahreskog (2006), the high use of derivatives by South African companies stands in contrast to the lower use of derivatives by large companies located in other developing countries.

Derivative use is more prevalent in firms with higher exposures to interest rate risk, exchange rate risk and commodity prices. Furthermore, compared to firms that do not use derivatives, firms that use derivatives have lower cash volatility, idiosyncratic volatility and systematic risk. Nonfinancial firms employ derivatives with the motive and effect of risk reduction (Bartram et al, 2008). Bartram et al (2009) found that firms with less liquid derivative markets, typically in middle income countries, are less likely to hedge. Conversely, firms which are typically located in countries with higher economic and financial risk prefer to hedge more often, when all other factors are equal.

2.8 Summary

Previous research in the field suggests that derivative usage as a risk management tool is extensive and widespread. Value creation is one of the fundamental arguments for derivative usage. Prior research of usage of derivatives in the mining sector suggest yet again fundamentally different justifications ranging from increased commodity price risk to a greater need for cash flow certainty during significant CAPEX investment. In terms of the relationship between firm size and derivative usage, there is overwhelming support for the existence of a positive relationship between firm size and derivative usage, yet opposing views are prevalent. In terms of risks most commonly hedged by corporations, foreign exchange rate risk, interest rate risk and commodity price risk were most common. Of the derivatives most frequently employed by companies, forwards, options and swaps were found to be significant. Highly leveraged firms and competitive industries were the two most common company characteristics that resulted in an increased prevalence of derivative usage. Finally, prior literature dealing with country specific derivative usage suggests that in many cases significant differences do exist between the countries.

To arrive at a deeper understanding of derivative usage in the mining industry, empirical research will be undertaken. Specifically, such research will investigate the prevalence of derivative usage across each country, each mining sector, each derivative type, as well as the extent of use of each derivative instrument.

In the next section of this study, the research methods used to capture the empirical data, including details on the research strategy adopted, the data collection techniques, sample selection and data validity and reliability will be explained.

Chapter 3: Research Methodology

3. Introduction

In this study, two approaches were adopted to produce a more comprehensive and nuanced response to the research questions.

The study seeks to answer the following research questions:

1. To what extent are derivatives used by firms in the mining sector in South Africa, Australia and the United Kingdom?
2. What are the similarities or differences between derivative usage in mining companies in South Africa, Australia and the United Kingdom?
3. What risks are most often hedged by mining companies?
4. What is the effect of firm size and derivatives usage in the mining sector?
5. What is the effect of industry differentiation on derivative usage in the mining sector?

Quantitative methods were used to analyse the statistical data and to develop an analysis to identify differences in derivative usage between countries, mining subsectors, as well as size categories of mining companies within the sectors. A qualitative approach was adopted in analysing data from interviews with sector analysts, who provided insights into the quantitative data from their personal knowledge and experience.

3.1 Research Methodology 1: Quantitative Phase

A chi-square test for proportions was used to analyse two samples of data at one time, and to identify whether a significant difference exists between the two proportions within the samples. This was initially applied to pairs of data sets on an overall basis between countries, to ascertain whether significant differences exist between derivative usage patterns between South Africa (RSA), UK and Australia (AUS). Thereafter, within each country, the companies were classified into size categories based on their market capitalisation as at 31/12/2009, e.g., R2001m+; R1501m-R2000m; R1001-1500m. As at 31 December 2009, the ZAR/AUD exchange rate was R6.6246/A$1 and the ZAR/GBP exchange rate was R11.8144/£1. The AUD and GBP market capitalisations were translated at the aforementioned rates of exchange. Within each country, these size categories were then compared on a systematic basis to identify whether differences in derivative usage exist as a result of differences in company size, e.g.,

AUS- R2001m+ vs R1501m-R2000m. Thereafter, each size category was then compared across each country, in order to assess whether a particular size category had different derivative usage patterns across different countries, e.g., R2001m+- AUS vs UK.

The companies were then divided into specific subsectors, e.g., General Mining, Coal Mining, Platinum and Precious metals Mining etc. Within each country, each specific subsector was then compared, in order to assess whether internal differences in subsector derivative usage apply, e.g., RSA- General Mining vs Coal Mining. Thereafter, each subsector category was then compared across the three countries in order to identify whether differences in derivatives usage exist between specific subsectors across different countries e.g. Platinum and Precious Metals Mining- RSA vs AUS.

Finally, within each country, each derivative type was compared, in order to analyse whether there are significant differences in usage between particular derivatives, e.g., RSA- Commodity Forwards vs. Commodity Options. This test was then conducted internally for each country. Lastly, each commodity was compared across each country in order to assess whether a particular derivative is more prevalent in a particular region, or whether derivative usage patterns are uniform across the different countries e.g. Commodity Forwards- UK vs. AUS.

3.1.1 Research population:

The population consisted of 46 JSE listed companies across the Metals and Minerals Sector, as well as the Mining Sector. The Australian population consisted of 559 ASX listed companies across both the Metals and Minerals Sector and the Mining Sector. The UK population consisted of 138 LSE listed companies across both the Metals and Minerals Sector, as well as the Mining Sector.

The LSE listed companies consist primarily of worldwide mining companies as opposed to UK based companies. The inclusion of LSE listed companies facilitates the analysis of mining firms, with operations in South Africa or Australia, which are not listed on the ASX or JSE, e.g., Anglo American. In addition, the LSE inclusion enables an analysis of IFRS-compliant mining companies, not otherwise required by their local listing exchanges to present IFRS-compliant financial statements, e.g., Antofagasta, Kazakhmys and Petropavlovsk.

3.1.2 Sample Size:

The extensive population size facilitated the use of a non probability method by way of quota sampling. The respective populations were segmented into mutually exclusive sub-groups based on market

capitalisation as at 31 December 2009. Then judgment was used to select the top 100 companies from each segment, based on a specified proportion. In the case of the South African population, all 46 companies were selected. For the UK and Australian populations, 100 companies were selected respectively.

3.1.3 Data Collection:

The Thomson Reuter's DataStream database was accessed through the DataStream terminal at the University of Cape Town Library. Constituents of the Metals and Minerals sector as well as the Mining sector as at the 31 December 2009 were exported to a Microsoft Excel spreadsheet. Thomson Reuters DataStream is the world's largest financial statistical database - covering an unrivalled wealth of asset classes, estimates, fundamentals, indices and economic data. Individual annual reports for the 246 companies were downloaded via the internet for the 2009 year end. In order for annual financial statements to be classified for the purposes of this study as being a 2009 year end, the company's year-end had to fall between 1/4/2009 and 31/3/2010. Once downloaded, each annual report was scrutinised using the Adobe Acrobat search function for key words. Keywords included: "option", "hedge", "hedging", "exchange", "forward", "future", "derivative", "swap", "commodity" and "commodities". In addition, relevant risk management sections were thoroughly read to identify any evidence of derivative use not otherwise found using the search function. Concurrently a Microsoft Excel spreadsheet was established for each country wherein data found was entered.

The Excel spreadsheet (Annexure B) which ranked each company in each respective country by market capitalisation was complied. A column was established for each derivative identified, i.e., Commodity forward, commodity option, currency forward, currency option and swap. Boolean logic – a complete system for logical operations, used often since popularisation of mathematical logic and computer programming was employed to identify "1" for yes, to indicate evidence that the particular derivative usage exists, and "0" for no, to indicate that no evidence of the particular derivative usage exists. Further columns adjacent to the Boolean column were established, detailing further information on the particular derivative, e.g., which commodity was hedged; how much of the commodity was hedged; which currency was hedged.

Thereafter, within each country, the companies were classified into size categories based on their market capitalisation as at 31/12/2009. The companies were further divided into size categories using the following criteria:

Market Capitalisation	Size Category
R0m-R250m	1
R251m-R500m	2
R501m-R1000m	3
R1001m-R1500m	4
R1501m-R2000m	5
R2001m+	6

Market capitalisations for the LSE and ASX listed companies were translated using the spot exchange rates on the 31/12/2009 for the purposes of this exercise.

In addition to the above size segmentation, sub-sector classification of the individual companies was downloaded using the Reuters DataStream terminal. This facilitated further analysis of a particular sub-sector and their derivative usage prevalence. Subsectors consisted of the following categories:

Sub-sector classification	Sub-sector Category
General Mining	1
Platinum & Precious Metal	2
Gold Mining	3
Diamonds & Gemstones	4
Iron & Steel	5
Coal	6
Nonferrous Metals	7
Aluminium	8

3.1.4 Data Analysis:

All statistical analysis was performed using the PC based statistical package IBM SPSS Statistics 19.

A chi-square test of homogeneity was conducted on the data. The test is applied to a single categorical variable from two different populations. It is used to determine whether frequency counts are distributed identically across different populations. Samples with various proportions of derivative usage or non usage were compared in order to identify statistically significant relationships between inter-country size categories, intra-country sector categories, inter-country size categories, inter-country sector categories as well as inter-country usage as a whole.

There is a choice of test statistics for testing the null hypothesis H0: p1=p2 (the population proportions are equal) against H1: p1 ≠ p2 (the population proportions are not equal). The test is performed by calculating one of these statistics and comparing its value to the percentiles of the standard normal distribution to obtain the observed significance level. If this P value is sufficiently small, the null hypothesis is rejected.

3.1.5 Validity and reliability:

Validity of a test or a measurement tool is established by demonstrating its ability to identify or measure the variables or constructs that it proposes to identify or measure. Joppe (2000) defines reliability as the extent to which results are consistent over time and are an accurate representation of the total population under study. If the results of a study can be reproduced under a similar methodology, then the research instrument is considered to be reliable. In this study, the results could be replicated in a similar study using the same methodology.

3.2 Research Methodology 2: Qualitative Phase

Qualitative research means "any kind of research that produces findings not arrived at by means of statistical procedures or other means of quantification" (Strauss & Corbin, 1990). The purpose of the qualitative phase of the study was to determine whether the factors identified in the literature review and findings from the quantitative research determining derivative usage in the mining industry across South Africa, Australia and the United Kingdom were valid and reliable and aligned with the personal knowledge and experience of the respondents. Furthermore, additional industry practice insights were

expressed by the interviewees during the interview process, thus contributing to the development of a textured and deeper understanding of the topic. This triangulation of the quantitative data also serves to add credibility and trustworthiness to the findings.

3.2.1 Research Population:

The population was comprised of four respondents, comprising financial directors, financial managers and analysts working in or covering companies in the mining industry.

3.2.2 Sample size:

A judgment sample of four respondents, consisting of:

- 3 Resource fund managers
- 1 Chief executive officer of a mining company

were interviewed.

3.2.3 Sampling methodology:

The respondents represented a broad spectrum of industry opinions and judgement sampling was employed to provide a range of respondents who were most advantageously placed to provide the information required, subject to their availability and willingness to participate.

3.2.4 Data Collection:

The respondents were contacted telephonically and the purpose of the research was explained to them. Appointments to conduct face to face interviews were arranged. Prior to the interview, copies of the graphical results of the quantitative data were e-mailed to each respondent. This data formed the basis of the discussion during the interviews. In addition, each respondent was asked an open-ended question about their opinion on the use of derivatives in the mining industry.

The respondents represented industry experts in the mining sector. As such, the data reflects their personal opinions, as accurately as possible. The qualitative study sought the views of the experts on the results of the quantitative research, which dealt with hedging and derivative usage in the mining sector across the three stock exchanges. Such views and opinions further served to internally validate the quantitative phase.

3.2.5 Data Analysis:

Notes were taken by the researcher during the interviews. These were read over and over again until the researcher had immersed himself in the contents. Thereafter, general themes across this data emerged from the four interviews and were identified as common topics. The data on each topic was combined to develop a composite understanding of each theme. These themes are described and analysed in the chapter on the findings of the study.

3.2.6 Validity and Reliability:

In qualitative research, the terms credibility and trustworthiness, associated with rigour and the quality of the research, are preferred. These aims may be achieved through the use of triangulation, using different methods of data collection and data analysis, as was done in this study. The comparison and discussion of the quantitative data within the qualitative analysis serve to enhance the reliability of the findings.

3.3 Concluding remarks:

The two approaches adopted in the study have been reviewed and described above. The methods of identifying the samples selected and the methods of data collection and analysis have been detailed. In the following chapter, an exposition of the findings will be undertaken.

Chapter 4: Quantitative Findings

4. Introduction

In this chapter, the findings of the statistical analysis will be discussed. The chapter presents the research questions as stated in Chapter 1 and then presents the quantitative results in order to address each question. The quantitative results relating to the research questions are then critically compared with the findings of prior studies relating to hedging in the mining industry, to provide an overview on the significance of the findings. The chapter concludes with an overview of the quantitative results relating to hedging in the mining industry, obtained through the interviews.

In spite of the sample encompassing 100% of the population of South African listed mining companies, 96.4% of the total ASX mining market by market capitalisation and 99.2% of the LSE listed mining market capitalisation as a whole, the industry classifications and size categorisations across the three markets were somewhat unevenly distributed. This distribution may have an impact on the results obtained.

The composition of the companies analysed in the study were as follows:

Composition of companies by Industry Classification in study:

Industry Classification	South Africa		Australia		United Kingdom		Total
Exchange	**JSE Listed (No of companies)**	**% of Country Composition**	**ASX Listed (No of companies)**	**% of Country Composition**	**LSE Listed (No of companies)**	**% of Country Composition**	
General Mining	14	30%	45	45%	4**5**	45%	99
Platinum and Precious Metals	5	11%	5	5%	5	5%	13
Gold Mining	9	20%	26	26%	26	26%	54
Diamonds and Gemstone	5	11%	8	8%	8	8%	14
Iron & Steel	7	15%	9	9%	2	2%	18
Coal	3	7%	12	12%	9	9%	24
Non Ferrous Metals	2	4%	13	13%	5	5%	20
Aluminium	1	2%	3	3%	0	0%	4
Total	**46**	**100%**	**100**	**100%**	**100**	100%	**246**

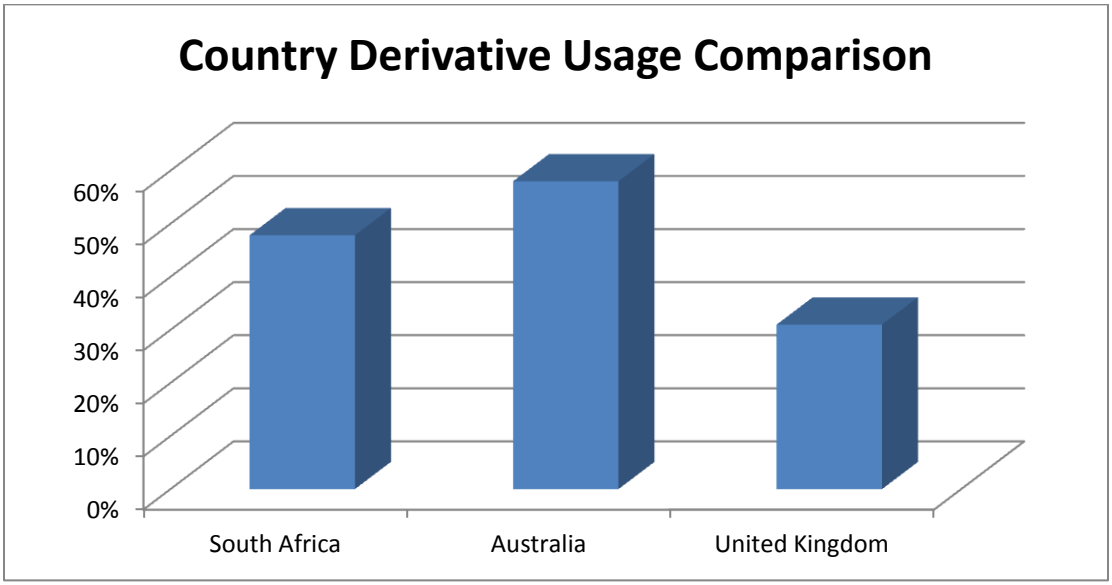
Composition of companies by Size Classification in study:

Market Capitalisation	South Africa		Australia		United Kingdom		Total
	JSE Listed (No of companies)	% of Country Composition	ASX Listed (No of companies)	% of Country Composition	LSE Listed (No of companies)	% of Country Composition	
R2001m+	19	41%	74	74%	23	23%	120
R1501m-R2000m	2	4%	11	11%	1	1%	14
R1001m-R1500m	2	4%	15	15%	5	5%	22
R501m-R1000m	5	11%	0	0%	9	9%	14
R251m-R500m	3	7%	0	0%	28	28%	31
R0m-R250m	15	33%	0	0%	34	34%	49
Total	**46**	**100%**	**100**	**100%**	**100**	**100%**	**246**

4.1 Research question 1: To what extent are derivatives used by firms in the mining sector in South Africa, Australia and the United Kingdom?

The 246 annual financial statements of the respective mining companies listed on the JSE, ASX and LSE were analysed in order to identify at a high level the overall derivative usage rates and whether on a graphical basis a difference is evident. The results are presented below.

4.1.1 Graphical Results: Hedging prevalence by country



For mining companies listed on the JSE, 48% used one or more derivatives, 52% used no derivatives. The South African results were similar to the results of mining companies listed on the ASX, whereby 44% used one or more derivatives, 56% used no derivatives. In sharp contrast, for mining companies listed on the LSE, 29% used one or more derivatives, 71% used no derivatives. Given the fact that the United Kingdom represents LSE listed companies and not UK domiciled companies per se, it is not appropriate to deduce that UK mining companies hedge less than South African or Australian companies. Companies listed on the LSE tend to be global diversified mining companies seeking access to capital by listing on the LSE. Given the diversity of LSE listed mining companies, it may however be appropriate to view the UK category as being a proxy worldwide mining companies.

Similar to Berkman et al (1997), there appears to be a trend that the smaller more open economies such as South Africa and Australia, compared to the UK, tend to have higher usage rates of derivatives. This trend may possibly to be due to increased exposure to exchange rate movements. The findings also corroborate Geczy et al (1997), who found that firms with greater growth opportunities i.e. South African and Australian listed entities with extensive foreign exchange rate exposure, were more likely to use derivatives. Bodnar & Gebhardt (1999) found significant similarities in the general patterns of usage across industry and firm size, between German and US firms. Such findings give credence to the similarities between the South African and Australian listed company results. South Africa differs from the United Kingdom and Australia in the respect that the former is a non-OECD country whilst the latter

two are indeed OECD countries. It is interesting to note then that Bartram et al (2009) found that 64.3% of companies in OECD countries used derivatives whilst only 39.6% of companies in non-OECD countries used derivatives to hedge risks. In spite of the study being a minor sample of OECD vs non-OECD countries, the results obtained in the study would appear to refute the aforementioned findings.

This is in line with the findings of Correia, Holman and Jahreskog (2006), who found that the high use of derivatives by South African companies stands in contrast to the lower use of derivatives by large companies located in other developing countries. The findings also tend to conflict with Bartram et al (2009), who found that firms with less liquid derivative markets, typically in middle income countries, are less likely to hedge. South Africa would appear to an anomaly in this respect. Conversely, firms which are typically located in countries with higher economic and financial risk prefer to hedge more often, when all other factors are equal. The United Kingdom results would also appear to conflict with the aforementioned findings.

4.2 Research Question 2:

What are the similarities or differences between derivative usage in South Africa, Australia and the United Kingdom?

4.2.1 Statistical results: Country differences overall

A Chi-Square test for proportions was used to analyse two samples of data at one time, and to identify whether a significant difference exists between the two proportions within the samples with a 95% level of confidence. This was initially applied to pairs of data sets on an overall basis between countries, to ascertain whether significant differences exist between derivative usage patterns between South Africa (RSA), UK and Australia (AUS). The results of the statistical tests are discussed below. The full statistical outputs illustrating each test and the results thereof can be found in Annexure B.

The hypothesis for the statistical test was as follows:

H_0: $X_1 = X_2$

H_1: $X_1 \neq X_2$

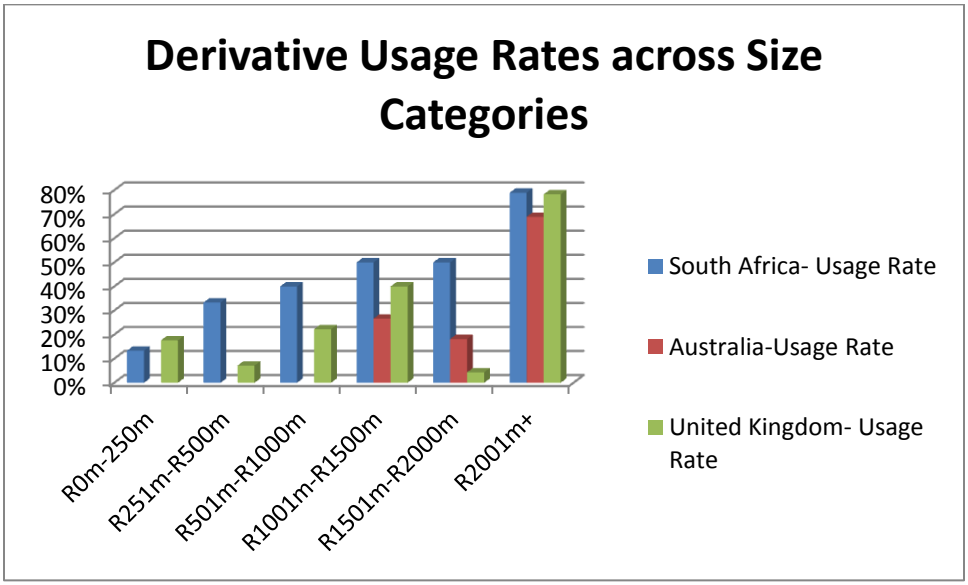
At a 5% significance level, the results for the various tests were as follows:

Country Differences and Derivative Usage	Pearson Chi-Square	Asymp. Sig.(2 sided)	Statistically different at 5% level?
RSA vs UK	3.858	0.049	**Yes**
RSA vs AUS	1.068	0.301	No
UK vs AUS	13.718	0.000	**Yes**

Statistically significant differences in derivative usage exist between South African and the United Kingdom listed companies. Furthermore, statistically significant differences exist between derivative usage patterns between Australian and UK listed corporations. There is no statistically significant difference between derivative usage in South African and Australian listed companies.

Size differences across countries and derivative usage

In order to identify similarities or differences between the size of companies and the respective derivatives usage rates in South Africa, Australia and the United Kingdom a graph was plotted with the results of the size categories and the usage rates of derivatives across the three countries.



The results tend to be in line with traditional thought on the subject regarding the fact that that transactional costs exhibit economies of scale. As such, large firms are expected to gain more from derivative use. This justification emanates from the ability of larger firms to bear the higher costs, as well as the lower cost of setting up a derivative programme for risk management (Warner, 1977). The results, similar to the majority of the studies, are in direct conflict with those of Nance et al (1993), who suggest that smaller firms are more likely to hedge than larger firms, because the direct costs of financial distress are less than proportional to the firm size. As discussed previously this trend is probably due to the fact that traditionally, smaller firms have found it more difficult to issue fixed income securities and participate in formal exchanges due to the required sophistication and systems requirements.

The results were further largely in agreement in respect of the size findings of Nance et al (1993) who, in their Fortune 500 study found supporting evidence that a firm is more likely to use derivatives if it is:

1. large in size;
2. highly leveraged;
3. has more growth opportunities;
4. has a higher dividend yield, but is less liquid.

Francis & Stephan's (1993) argument that larger firms hedge in order to reduce scrutiny of variable earnings, by using derivatives to hedge accounting earnings has merit in light of the results. Hedging programmes require a sophisticated understanding of derivatives and appropriate risk management and accounting systems. Smaller firms are lacking in such systems and risk management. Furthermore, the positive relationship between a firm's size and derivative usage can be justified due to the fact that smaller firms will tend to have smaller foreign currency exposure as they will be more locally orientated in terms of their sales and procurement versus their larger multinational counterparts. The results are consistent with El Masry's (2006) findings that larger firms are more likely to use derivatives than medium and smaller firms.

Stulz (1996) and Dionne & Triki (2004) have merit in the respect that they suggest that risk management is an expensive activity. It is for this reason that small firms might not be able to afford to implement a derivatives programme. Mian's (1996) further suggest the argument relating to economies of scale in hedging and that information and transaction considerations have more influence on hedging than the cost of raising capital. The findings in this study are largely in agreement with the aforementioned hypotheses. Judge (2006) takes a view that larger firms and firms with more cash are more likely to hedge with derivatives. This aligns with the large majority of theories presented above.

Rothman's (2001) findings that non-use of derivatives stemmed from high establishment costs, as well as maintenance costs associated with difficult pricing and valuing issues surrounding derivatives have merit in light of the graphical findings in this study. Derivative programmes are indeed costly, and as such, unaffordable for the average small firm. It would appear superficially that this is indeed the reality when analysing the graphical results.

4.2.2Statistical results: Size differences across countries and derivative usage

A Chi-square test for proportions was used to analyse two samples of data at one time, and to identify whether a significant difference exists between the two proportions within the samples with a 95% level of confidence. This was applied to size categories across South Africa (RSA), UK and Australia (AUS) in order to identify whether or not statistically significant differences exist between the mining companies of the same size across the different countries. This test was necessitated by virtue of the discrepancies in the distribution of companies across the size categories i.e. perhaps the differences between LSE listed companies and ASX listed companies is due to the fact that there are more companies with R2001m+ market capitalisations in the ASX sample.

Size Differences across Countries and Derivative Usage

Market Cap

R2001m+	**Pearson Chi Square**	**Asymp. Sig. (2 Sided)**	**Statistically different at 5% level?**
RSA vs UK	0.003	.957	No
RSA vs AUS	0.738	0.390	No
UK vs AUS	0.746	0.388	No

Companies within the size category of "Market capitalisation in excess of R2 billion" were not statistically different across the three countries in terms of derivative usage.

Market Cap

R1501m-R2000m	**Pearson Chi Square**	**Asymp. Sig. (2 Sided)**	**Statistically different at 5% level?**
RSA vs UK	0.75	0.386	No
RSA vs AUS	0.965	0.326	No
UK vs AUS	3.273	0.070	No

Companies within the category of "Market capitalisation between R1501m-R2000m" were not statistically different across the three countries in terms of derivative usage.

Market Cap

R1001m-R1500m	Pearson Chi Square	Asymp. Sig. (2 Sided)	Statistically different at 5% level?
RSA vs UK	0.058	0.809	No
RSA vs AUS	0.463	0.496	No
UK vs AUS	0.317	0.573	No

Companies within the category of "Market capitalisation between R1001m-R1500m" were not statistically different across the three countries in terms of derivative usage.

Market Cap

R501m- R1000m	Pearson Chi Square	Asymp. Sig. (2 Sided)	Statistically different at 5% level?
RSA vs UK	0.498	0.480	No

As the ASX sample did not have mining companies with a market capitalisation of less than R1000m, only the UK and RSA samples were compared. Companies within the category of "Market capitalisation between R501m-R1000m" were not statistically different across the three countries in terms of derivative usage.

Market Cap

R251m-R500m	Pearson Chi Square	Asymp. Sig. (2 Sided)	Statistically different at 5% level?
RSA vs UK	1.287	0.257	No

As the ASX sample did not have mining companies with a market capitalisation of less than R1000m, only the UK and RSA samples were compared. Companies within the category of "Market capitalisation between R251m-R500m" were not statistically different across the three countries in terms of derivative usage.

Market Cap

R0m-R250m	Pearson Chi Square	Asymp. Sig. (2 Sided)	Statistically different at 5% level?
RSA vs UK	0.142	0.707	No

Companies within the category of "Market capitalisation between R0m-R250m" were not statistically different across the three countries in terms of derivative usage.

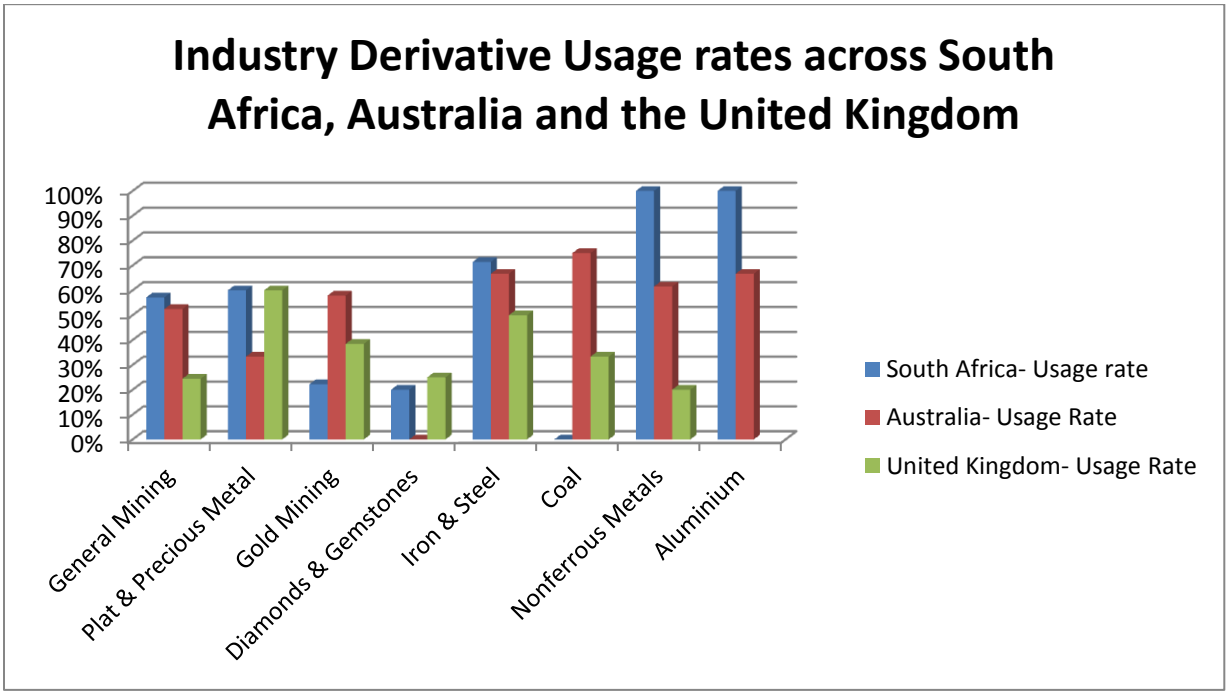
Conclusion: Derivative usage rates across countries holding size category constant

It would appear that statistically, there are no differences between derivative usage rates of mining companies across the respective countries derivatives when holding the size category constant. These results seem plausible given the aforementioned discussion of prior studies which suggest that larger companies will tend to use derivatives more than their smaller counterparts predominantly due to:

1. High establishment costs of derivative programmes
2. Expensive expertise required for risk management programmes
3. Greater forex exposure

Industry Derivative usage Rates across South Africa, Australia and the United Kingdom

In order to identify similarities or differences between the industry derivative usage and derivatives usage rates in South Africa, Australia and the United Kingdom a graph was plotted with the results of the size categories and the usage rates of derivatives across the three countries.



4.2.3 Statistical results: Industry differences across countries and derivative usage

A chi-square test for proportions was used to analyse two samples of data at one time, and to identify whether a significant difference exists between the two proportions within the samples with a 95% level of confidence. The statistical results below illustrate the results of the Chi Squared test holding the industry consistent and comparing the results across the various countries.

Industry Differences across Countries and Derivative Usage

General Mining	**Pearson Chi-Square**	**Asymp. Sig.(2 sided)**	**Statistically different at 5% level?**
RSA vs UK	4.981	0.026	**Yes**
RSA vs AUS	0.090	0.764	No
UK vs AUS	6.719	0.010	**Yes**

In the general mining sector, there was a statistical difference in derivative usage between the UK and Australia, as well as between South Africa and the United Kingdom.

Plat & Precious Metals	**Pearson Chi-Square**	**Asymp. Sig.(2 sided)**	**Statistically different at 5% level?**
RSA vs UK	0.000	1.000	No
RSA vs AUS	0.533	0.465	No
UK vs AUS	0.533	0.465	No

In the Platinum and precious metals sector, there were no statistical differences in derivative usage between the UK, Australia and South Africa.

Gold Mining	Pearson Chi-Square	Asymp. Sig.(2 sided)	Statistically different at 5% level?
RSA vs UK	0.783	0.376	No
RSA vs AUS	0.783	0.376	No
UK vs AUS	3.125	0.077	No

In the Gold mining sector, there were no statistical differences in derivative usage between the UK, Australia and South Africa.

Diamonds & Gemstones	Pearson Chi-Square	Asymp. Sig.(2 sided)	Statistically different at 5% level?
RSA vs UK	0.325	0.569	No
RSA vs AUS	0.600	0.439	No
UK vs AUS	0.321	0.571	No

In the Diamonds and Gemstones sector, there were no statistical differences in derivative usage between the UK, Australia and South Africa.

Iron & Steel	**Pearson Chi-Square**	**Asymp. Sig.(2 sided)**	**Statistically different at 5% level?**
RSA vs UK	0.321	0.571	No
RSA vs AUS	0.042	0.838	No
UK vs AUS	0.196	0.658	No

In the Iron and Steel sector, there were no statistical differences in derivative usage between the UK, Australia and South Africa.

Coal	**Pearson Chi-Square**	**Asymp. Sig.(2 sided)**	**Statistically different at 5% level?**
RSA vs UK	1.333	0.248	No
RSA vs AUS	5.625	0.018	**Yes**
UK vs AUS	3.646	0.056	No

In the Coal sector, there was a statistical difference in derivative usage between South Africa and Australia.

Nonferrous Metals	Pearson Chi-Square	Asymp. Sig.(2 sided)	Statistically different at 5% level?
RSA vs UK	4.444	0.035	**Yes**
RSA vs AUS	1.154	0.283	No
UK vs AUS	3.316	0.069	No

In the Non ferrous metals sector, there was a statistical difference in derivatives usage between South Africa and the UK.

Aluminium	Pearson Chi-Square	Asymp. Sig.(2 sided)	Statistically different at 5% level?
RSA vs UK	0.444	0.505	No

In the Aluminium sector, there was not any statistical significant difference in derivatives usage between South Africa and Australia.

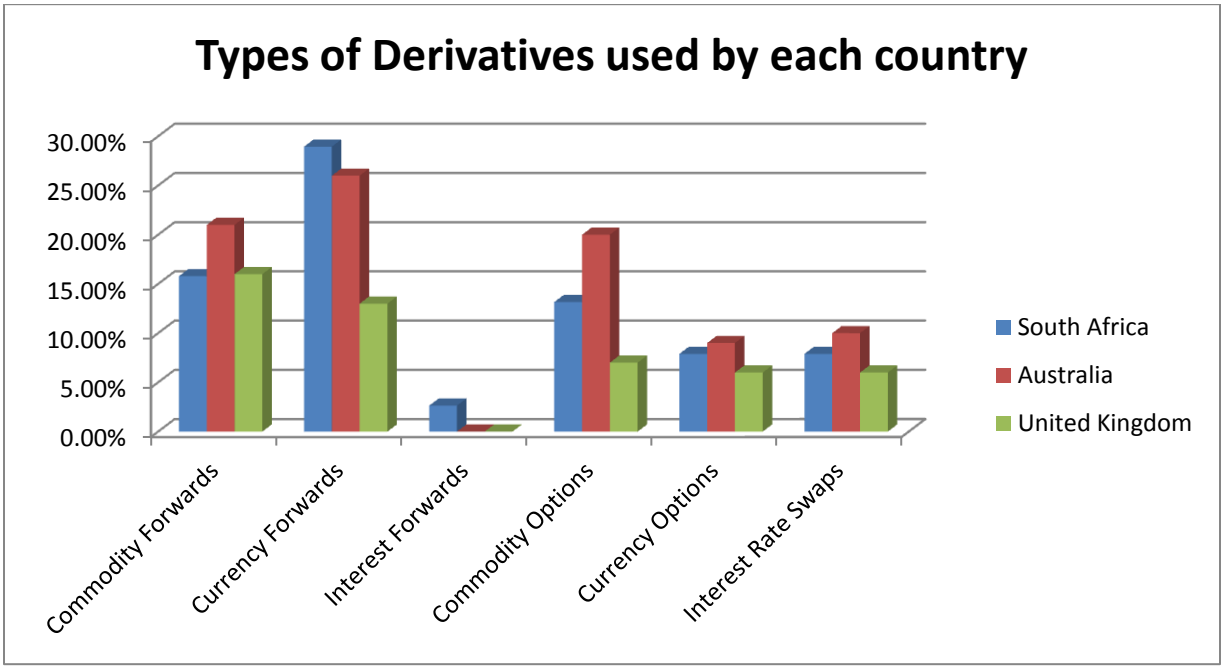
Conclusion: Derivative usage rates across countries holding industry sector constant

It is interesting to note that the results for General Mining which suggest that statistically there are differences in derivative usage between the UK and AUS and the UK and RSA but not between RSA and AUS mimic the results of the overall country differences. It would appear that the General Mining category given that it comprises 30%, 45% and 40% of the South Africa, Australian and United Kingdom composition of total companies sampled should reflect overall country levels.

The two anomalous statistical results were that in the Coal sector, South Africa and Australia had statistically significant differences between derivative usage policies. Furthermore, in the Non ferrous metals industry there were statistically significant differences between derivative usage patterns between the United Kingdom and South Africa. The apparent anomalies will be discussed in the qualitative findings sections of Chapter 5.

4.2.4 Derivative type differences across countries

In order to identify similarities or differences between derivatives usage in South Africa, Australia and the United Kingdom a graph was plotted with the results of the derivative type usages across the three countries.



It would appear that the graphical results obtained are largely in line with those found by El Masry (2006) who found that in the UK, the most common instrument to hedge the exposures to foreign exchange risk, interest rate risk, commodity risk and equity risk are forwards (29%). It is however interesting to note that the results are however in conflict with El Masry (2006) who also found that the usage rate of forwards this is followed by swaps and then options. The graphical results would suggest that in the case of hedging of interest, forward rate agreements are largely negligible and swaps are in fact preferable in the mining sector. This phenomenon may be due to the fact that interest rate forwards tend to be short term instruments and thus in spite of them being used more often during the financial year than swaps, are in fact not recorded on the financial statement at year end- the period looked at in this study. The results are in agreement with Howton & Perfect (1998) who found that amongst US firms, swaps are the most often used interest rate contract, and forwards are the most often used currency contract. In line with these findings, Benson & Oliver (2004), in their Australian

study found that forwards, options and swaps are the more common contracts that are used to hedge risk there. The results further concur with Benson & Oliver's (2004) additional findings whereby the main risks hedged are foreign currency and interest rate risks.

Statistical results: Derivative type differences across countries

A chi-square test for proportions was used to analyse two samples of data at one time in order to determine whether or not holding the derivative constant, there were differences in usage between South Africa, Australia and the United Kingdom i.e. are there differences in usage rates of commodity forwards between South Africa and Australia. The statistical results can be found below.

Forwards:

Derivative Type differences across Countries and Derivative Usage

Commodity Fwd	**Pearson Chi-Square**	**Asymp. Sig.(2 sided)**	**Statistically different at 5% level?**
RSA vs UK	0.282	0.595	No
RSA vs AUS	0.217	0.641	No
UK vs AUS	1.561	0.212	No

In terms of commodity forwards, there were no statistically significant differences between South Africa, Australia and the United Kingdom.

Currency Fwd	Pearson Chi-Square	Asymp. Sig.(2 sided)	Statistically different at 5% level?
RSA vs UK	11.627	0.001	**Yes**
RSA vs AUS	0.010	0.921	No
UK vs AUS	17.149	0.000	**Yes**

In terms of currency forwards, there were statistically significant differences between South Africa and the United Kingdom as well as between the United Kingdom and Australia.

Interest Fwd	Pearson Chi-Square	Asymp. Sig.(2 sided)	Statistically different at 5% level?
RSA vs UK	2.189	0.139	No
RSA vs AUS	2.189	0.129	No
UK vs AUS	1.068	0.301	No

In terms of interest rate forwards, there were no statistically significant differences between South Africa, Australia and the United Kingdom.

Options:

Commodity Option	Pearson Chi-Square	Asymp. Sig.(2 sided)	Statistically different at 5% level?
RSA vs UK	0.924	0.336	No
RSA vs AUS	1.323	0.250	No
UK vs AUS	6.816	0.009	**Yes**

In terms of commodity options, there were statistically significant differences between the United Kingdom and Australia.

Currency Option	Pearson Chi-Square	Asymp. Sig.(2 sided)	Statistically different at 5% level?
RSA vs UK	7.788	0.005	**Yes**
RSA vs AUS	0.001	0.981	No
UK vs AUS	8.865	0.003	**Yes**

In terms of currency options, there were statistically significant differences between the United Kingdom and Australia as well as between South Africa and the United Kingdom.

Interest Rate Swap	Pearson Chi-Square	Asymp. Sig.(2 sided)	Statistically different at 5% level?
RSA vs UK	2.072	0.15	No
RSA vs AUS	0.563	0.453	No
UK vs AUS	6.818	0.009	**Yes**

In terms of interest rate swaps, there were statistically significant differences between the United Kingdom and Australia.

Conclusion: Country differences in derivative usage holding derivative type constant

It is interesting to note that there are no significant differences in many sectors yet from an overall perspective there are major differences. This apparent anomaly ostensibly stems from insufficient sample sizes between industries to facilitate accurate statistical comparisons.

Although not analysed in the study, Correia et al (2006) found that the use of futures and exchange traded options may reflect the impact of exchange controls as resident companies are restricted, for example, in the use of foreign exchange futures to hedge foreign exchange rate risk. The higher use of forwards, swaps and options is consistent with the results of Prevost et at (2000) for New Zealand

In terms of anomalous statistical results for currency options, there were statistically significant differences between the United Kingdom and Australia as well as between South Africa and the United Kingdom. The aforementioned results appear consistent with our expectations for the respective countries. The South African Rand and Australian Dollar are heavily resources driven currencies and tend to be far more volatile than most other currencies. As such, increased usage of currency options versus the United Kingdom sample would appear to be reasonable.

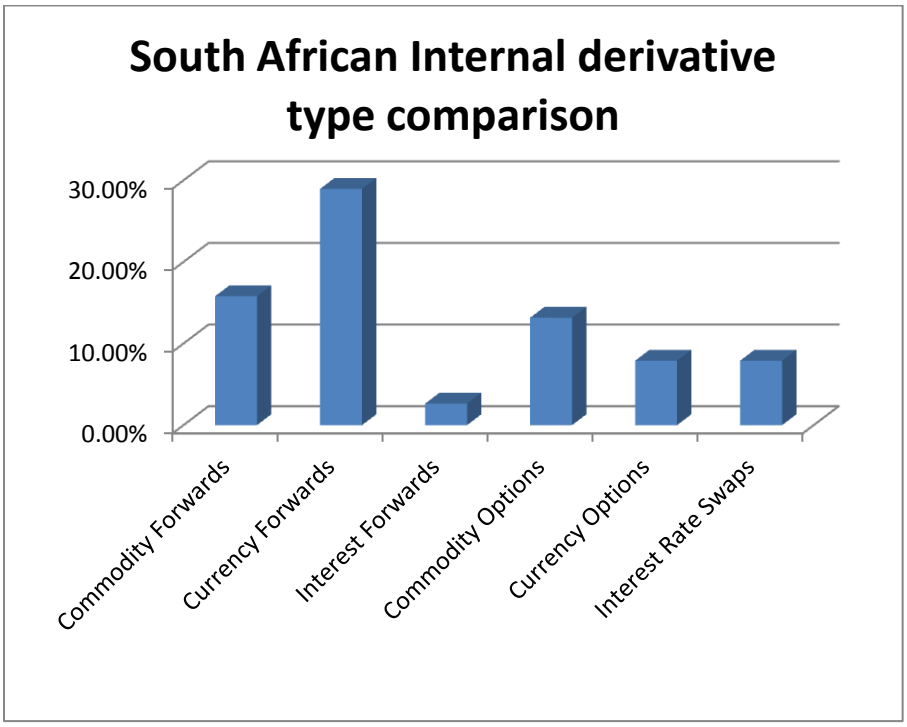
In terms of interest rate swaps, there were statistically significant differences between the United Kingdom and Australia and for commodity options; there were statistically significant differences between the United Kingdom and Australia. These results will be discussed in the qualitative findings section of Chapter 5.

What risks are most often hedged by mining companies?

There are three risks in total that the prior studies have identified: foreign exchange rate, interest rate as well as commodity price risk. The derivatives analysed in the study which address the aforementioned risks are commodity forwards, commodity options, currency forwards, currency options, interest rate swaps and forward rate agreements. The study shall initially present the findings of the internal derivative usage rates and the statistical significance of the difference between the different countries and the particular derivative usage rates and then attempt to draw similarities and differences between the various findings.

4.3.1 RSA by Derivative:

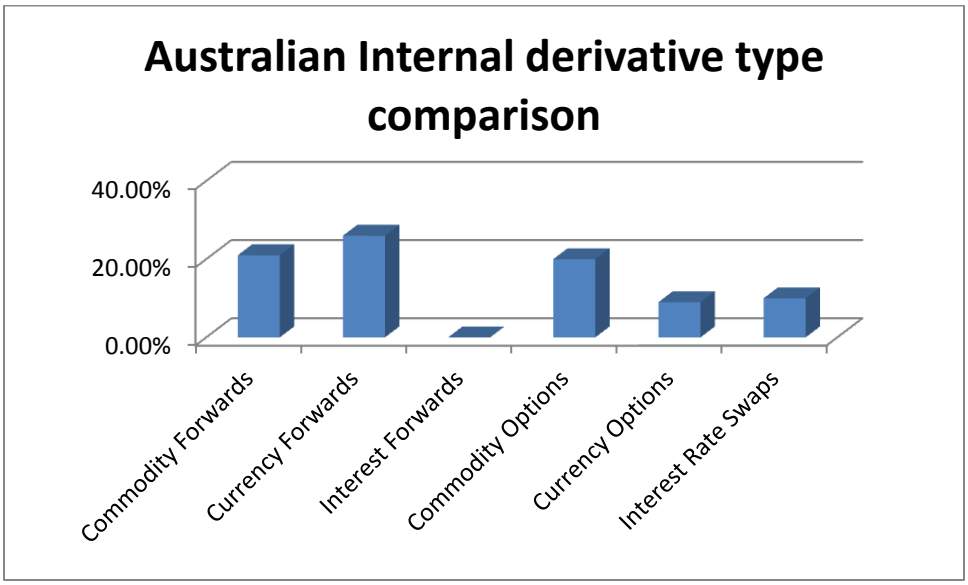
Isolating the South African market and analysing the graphical results of the derivative types employed yields the following results.



20% of JSE listed mining firms used commodity forwards, 80% did not. 39% of JSE listed mining firms used currency forwards, 61% did not.2% of JSE listed mining firms used interest rate forwards, and 98% did not. 13% of JSE listed mining firms used commodity options, 87% did not. 13% of JSE listed mining firms used interest rate swaps, 87% did not. 11% of JSE listed mining firms used currency options, 89% did not. The implications of the aforementioned results will be discussed below after the statistical results as well as in the qualitative section of the next chapter.

4.3.2 Australia by Derivative:

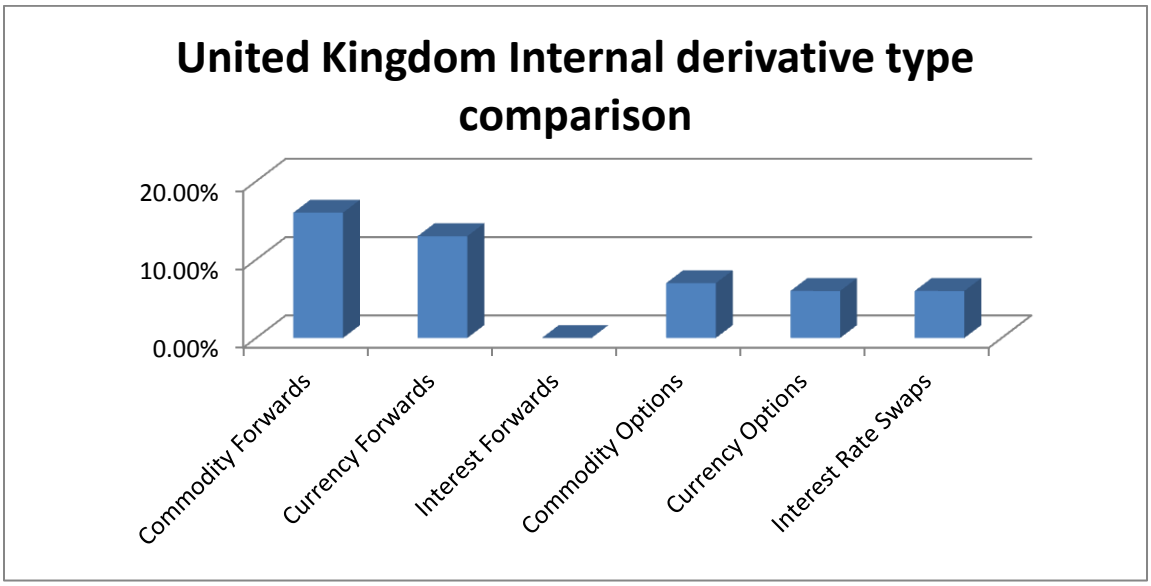
As above, a graphical representation of the derivative types utilised by the Australian listed entities results in some fascinating findings.



21% of ASX listed mining firms used commodity forwards, 79% did not.26% of ASX listed mining firms used currency forwards, and 74% did not. 0% of ASX listed mining firms used interest rate forwards, 100% did not.20% of ASX listed mining firms used commodity options, 80% did not. 10% of ASX listed mining firms used interest rate swaps, 90% did not. 9% of ASX listed mining firms used currency options, 91% did not. The implications of the aforementioned results will be discussed below after the statistical results as well as in the qualitative section of this chapter.

4.3.3 United Kingdom by Derivative:

A graphical representation of the UK listed entities gives an opportunity to assess any potential differences or similarities to those mining companies listed on the JSE or ASX exchanges.



16% of LSE listed mining firms used commodity forwards, 84% did not. 13% of LSE listed mining firms used currency forwards, 87% did not.0% of LSE listed mining firms used interest rate forwards, and 100% did not. 7% of LSE listed mining firms used commodity options, 93% did not. 1% of LSE listed mining firms used currency options, 99% did not.6% of LSE listed mining firms used interest rate swaps, 94% did not. The implications of the aforementioned results will be discussed below after the statistical results as well as in the qualitative section of this chapter.

4.3.4 Statistical Results: RSA Internal differences between types of derivatives used:

In terms of the statistical results, tests were performed within each country in order to identify whether statistical differences exist between derivative usage within each country. The results of which can be found below.

Derivative Type and Derivative Usage			
South Africa	**Pearson Chi-Square**	**Asymp. Sig.(2 sided)**	**Statistically different at 5% level?**
Commodity Fwd vs Currency Fwd	4.246	0.039	**Yes**
Commodity Fwd vs Interest Fwd	7.180	0.007	**Yes**
Commodity Fwd vs Commodity Option	1.348	0.246	No
Commodity Fwd vs Currency Option	0.717	0.397	No
Commodity Fwd vs Interest Rate Swap	19.169	0.000	No
Currency Fwd vs Interest Fwd	19.169	0.000	**Yes**
Currency Fwd vs Commodity Option	8.118	0.004	**Yes**
Currency Fwd vs Currency Option	9.797	0.002	**Yes**
Currency Fwd vs Interest Rate Swap	8.118	0.004	**Yes**
Interest fwd vs Commodity Option	3.886	0.049	**Yes**
Interest fwd vs Currency Option	2.853	0.091	No
Interest fwd vs Interest Rate Swap	3.886	0.049	**Yes**

Commodity Option vs Currency Option	0.103	0.748	No
Commodity Option vs Interest Rate Swap	0.000	1.000	No
Currency Option vs Interest Rate Swap	0.103	0.748	No

Within South Africa, there were statistically significant differences in derivative usage between Commodity Fwd vs Currency Fwd, Commodity Fwd vs Interest Fwd, Currency Fwd vs Interest Fwd, Currency Fwd vs Commodity Option, Currency Fwd vs Currency Option, Currency Fwd vs Interest Rate Swap, Interest fwd vs Commodity Option and Interest fwd vs Interest Rate Swap.

Conclusion: South African Internal differences between types of derivative used:

The graphical results of the South African sample would seem to suggest a strong bias towards currency forwards.

According to Correia et al (2006), the high use of derivatives in South Africa belies its role as a developing economy subject to exchange controls. Although the exchange controls were relaxed during 2010 for South African companies, this study was conducted prior to such amendment in legislation. Correia et al (2006) further found noted that the volatility of the Rand may make it imperative that companies undertake forward cover. Further, exchange controls may impact on derivative use positively as companies may be required to undertake forward sales of foreign currency receipts. In conclusion, currency is the most commonly hedged risk by South African listed mining companies. This is followed by commodity price risk, and then finally interest rate risk.

4.3.5 Statistical Results: Australian Internal differences between types of derivatives used:

Derivative Type and Derivative Usage			
Australia	**Pearson Chi-Square**	**Asymp. Sig.(2 sided)**	**Statistically different at 5% level?**
Commodity Fwd vs Currency Fwd	6.697	0.010	No
Commodity Fwd vs Interest Fwd	25.989	0.000	**Yes**
Commodity Fwd vs Commodity Option	0.117	0.733	No
Commodity Fwd vs Currency Option	5.103	0.024	**Yes**
Commodity Fwd vs Interest Rate Swap	0.767	0.381	No
Currency Fwd vs Interest Fwd	50.000	0.000	**Yes**
Currency Fwd vs Commodity Option	8.515	0.004	**Yes**
Currency Fwd vs Currency Option	22.134	0.000	**Yes**
Currency Fwd vs Interest Rate Swap	11.753	0.001	**Yes**
Interest fwd vs Commodity Option	23.464	0.000	**Yes**

Interest fwd vs Currency Option	11.640	0.001	**Yes**
Interest fwd vs Interest Rate Swap	19.870	0.000	**Yes**
Commodity Option vs Currency Option	3.720	0.054	No
Commodity Option vs Interest Rate Swap	0.287	0.592	No
Currency Option vs Interest Rate Swap	1.976	0.160	No

Within Australia there were statistically significant differences in derivative usage between Commodity Fwd vs Interest Fwd, Commodity Fwd vs Currency Option, Currency Fwd vs Interest Fwd, Currency Fwd vs Commodity Option, Currency Fwd vs Currency Option, Currency Fwd vs Interest Rate Swap, Interest fwd vs Commodity Option, Interest fwd vs Currency Option and Interest fwd vs Interest Rate Swap.

Conclusion: Australian Internal differences between types of derivative used:

On a simplistic cumulative basis, it would appear that commodity price risk (21% + 20%) is ostensibly more risky than currency (26% + 9%) risk which is more risky than interest rate risk for an Australian listed entity. This result seems plausible for a mining entity located in a country with historically minimal currency volatility. The findings are in line with those of Prevost et al (2000) who in their study of New Zealand firms found that firms tended to use OTC forwards to hedge currency risk and swaps to hedge interest rate risk. The findings are further in line with De Ceuster, Durinck, Laveren and Lodewyckx (2000) who found in their derivative usage survey of large firms in Belgium that firms mainly hedge currency risk, both current contractual obligations and anticipated transactions up to one year as well as interest rate risk. The results however conflict with De Ceuster et al (2000) in respect of commodity risk. De Ceuster et al (2000) found had a commodity derivative usage rate of 16%. The increased usage rate of commodity forwards and options is however in line with the fact that this study covers the mining sector.

4.3.6 Statistical Results: United Kingdom Internal differences between types of derivatives used:

Derivative Type and Derivative Usage			
United Kingdom	**Pearson Chi-Square**	**Asymp. Sig.(2 sided)**	**Statistically different at 5% level?**
Commodity Fwd vs Currency Fwd	0.157	0.692	No
Commodity Fwd vs Interest Fwd	17.391	0.000	**Yes**
Commodity Fwd vs Commodity Option	3.030	0.082	No
Commodity Fwd vs Currency Option	14.465	0.000	**Yes**
Commodity Fwd vs Interest Rate Swap	5.107	0.024	**Yes**
Currency Fwd vs Interest Fwd	15.054	0.000	**Yes**
Currency Fwd vs Commodity Option	1.839	0.175	No
Currency Fwd vs Currency Option	12.180	0.000	**Yes**
Currency Fwd vs Interest Rate Swap	3.556	0.059	No
Interest fwd vs Commodity Option	8.333	0.004	**Yes**

Interest fwd vs Currency Option	1.005	0.316	No
Interest fwd vs Interest Rate Swap	6.186	0.013	**Yes**
Commodity Option vs Currency Option	5.701	0.017	**Yes**
Commodity Option vs Interest Rate Swap	0.307	0.579	No
Currency Option vs Interest Rate Swap	3.701	0.054	No

Within the United Kingdom there were statistically significant differences in derivative usage between Commodity Fwd vs Interest Fwd, Commodity Fwd vs Currency Option, Commodity Fwd vs Interest Rate Swap, Currency Fwd vs Interest Fwd, Currency Fwd vs Currency Option, Interest fwd vs Commodity Option, Interest fwd vs Interest Rate Swap and Commodity Option vs Currency Option.

Conclusion: United Kingdom Internal differences between types of derivative used:

In conclusion, forwards contracts were more extensively and widely used than options. It would appear that commodity price risk and currency risk were equally the most hedged risks by UK listed mining companies. Interest rate risk was the least commonly hedged risk of the three risks. These results are in line with the findings of Grant and Marshall (1997) who in their study of large UK firms found that OTC forwards and options were used to hedge foreign exchange risk whilst swaps were used to hedge interest rate risk. The findings are further in line with Mallin, Ow-Yong and Reynolds (2001) who in their survey of UK firms, found that derivatives are mostly employed to hedge contractual obligations and that OTC forwards are mainly used to hedge foreign exchange rate risk whilst swaps are used to hedge interest rate risk.

4.3.7 Overall Conclusion: Risks hedged by mining companies

As discussed in the literature review, in terms of identifying risks most often hedged by companies, Aretz & Bartram (2009) noted a significant flaw in research papers that is particularly interesting to note. Most empirical studies classify firms as either 'hedgers' or 'non hedgers,' without allowing for the possibility that firms could move between the two groups over time. It must be noted that the results presented represent the derivatives in place at year end. This may or may not represent the underlying derivative usage rates during the financial year.

Nevertheless, it is interesting to note that the results across South Africa, Australia and the United Kingdom in terms of interest rate derivative are similar to those of the US companies surveyed in Bodnar et al's (2003) study who found that Dutch firms make use of forwards and options to hedge interest rate risk whilst USA firms tend mainly to use swaps to hedge interest rate risk.

The South African and Australian results suggesting significant usage of currency derivatives are in line with those of Chowdhry & Howe (1999) who found that corporations will engage in hedging only when there is significant exchange rate uncertainty. Furthermore, the findings concur with those of Judge (2006) who found the degree to which a firm's cash flows are affected by exchange rate changes will depend on the nature of its activities, such as the level of export and import activity, its involvement in foreign operations, and the competitiveness of its input and output markets. Given the significant import/export activity and substantial competitiveness of output associated with the mining industry, the results appear plausible.

Barring the United Kingdom results, the results would further corroborate the findings of El Masry (2006) who found that foreign exchange is the most commonly managed risk with derivatives. The findings are further substantiated by Correia, Holman and Jahreskog (2006) found that the overwhelming majority of South African firms used foreign exchange derivatives (74%); this was followed by interest rate derivatives (62%), then commodity derivatives (22%) and finally equity derivatives (8%). It must be noted that given the prior lack of research into mining sector derivative usage commodity derivative usage will tend to be substantially higher than prior studies.

4.4 Research question 4

What is the effect of firm size and derivatives usage?

4.4.1 Statistical Results Size Differences RSA Internal:

Statistical tests were performed within each country between the different size categories in order to identify whether or not statistically significant differences in derivative usage exists. The results can be found below:

Size Differences and Derivative Usage

South Africa	**Pearson Chi-Square**	**Asymp. Sig.(2 sided)**	**Statistically different at 5% level?**
R2001m+ vs R1501m-R2000m	0.836	0.361	No
R2001m+ vs R1001m-R1500m	0.836	0.361	No
R2001m+ vs R501m-R1000m	2.906	0.088	No
R2001m+ vs R251m-R500m	2.718	0.099	No
R2001m+ vs R0m-250m	14.435	0.000	**Yes**
R1501m-R2000m vs R1001m-R1500m	0.000	1.000	No
R1501m-R2000m vs R501m- R1000m	0.058	0.809	No
R1501m-R2000m vs R251m-R500m	0.139	0.709	No
R1501m-R2000m vs R0m-250m	1.633	0.201	No

R1001m-R1500m vs R501m- R1000m	0.058	0.809	No
R1001m-R1500m vs R251m-R500m	0.139	0.709	No
R1001m-R1500m vs R0m-250m	1.633	0.201	No
R501m- R1000m vs R251m-R500m	0.036	0.850	No
R501m- R1000m vs R0m-250m	1.667	0.197	No
R251m-R500m vs R0m-250m	0.720	0.396	No

In the South African size comparison, only companies with a market capitalisation exceeding R2 billion and those with a market capitalisation of R0–R250 million were statistically different in terms of their derivative usage. All other size categories were not statistically different in terms of derivative usage.

4.4.2 Statistical Results Size Differences AUS Internal:

Size Differences and Derivative Usage

Australia	**Pearson Chi-Square**	**Asymp. Sig.(2 sided)**	**Statistically different at 5% level?**
R2001m+ vs R1501m-R2000m	10.502	0.001	**Yes**
R2001m+ vs R1001m-R1500m	9.431	0.002	**Yes**
R1501m-R2000m vs R1001m-R1500m	0.257	0.612	No

The comparatively smaller size categories in the Australian sample are due to the fact that the top 100 Australian companies ranked by market capitalisation all had a market capitalisation in excess of R1bn.

In the Australian size comparison, companies with a market capitalisation exceeding R2 billion compared to those with a market capitalisation of R1501m-R2000m, and R1001m–R1500 million were statistically different in terms of their derivative usage. All other size categories were not statistically different in terms of derivative usage. One possible suggestion for this is that companies with market capitalisations in excess of R2bn have a far greater diversity of operations and countries within which they operate et they report in one currency in terms of financial results. As such they may tend to hedge their international currency exposures more than a company dominated by local operations.

4.4.3 Statistical Results Size Differences United Kingdom Internal:

Size Differences and Derivative Usage			
United Kingdom	**Pearson Chi-Square**	**Asymp. Sig.(2 sided)**	**Statistically different at 5% level?**
R2001m+ vs R1501m-R2000m	0.275	0.600	No
R2001m+ vs R1001m-R1500m	2.946	0.086	No
R2001m+ vs R501m-R1000m	8.667	0.003	**Yes**
R2001m+ vs R251m-R500m	27.787	0.000	**Yes**
R2001m+ vs R0m-250m	20.678	0.000	**Yes**
R1501m-R2000m vs R1001m-R1500m	1.200	0.273	No
R1501m-R2000m vs R501m- R1000m	2.593	0.107	No
R1501m-R2000m vs R251m-R500m	6.778	0.009	**Yes**
R1501m-R2000m vs R0m-250m	4.118	0.042	**Yes**
R1001m-R1500m vs R501m- R1000m	0.498	0.480	No
R1001m-R1500m vs R251m-R500m	3.065	0.080	No

R1001m-R1500m vs R0m-250m	1.336	0.248	No
R501m- R1000m vs R251m-R500m	0.831	0.362	No
R501m- R1000m vs R0m-250m	0.098	0.754	No
R251m-R500m vs R0m-250m	0.684	0.408	No

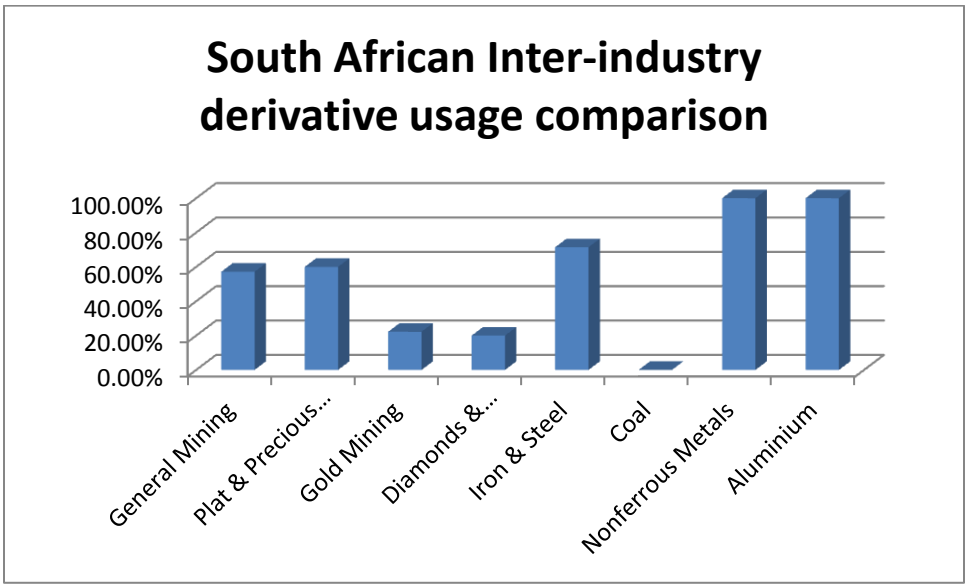
In the United Kingdom size comparison, companies with a market capitalisation exceeding R2 billion, when compared to those with a market capitalisation of R501m-R1000m, R251m-R500m and R0–R250 million were statistically different in terms of their derivative usage. Furthermore, companies with a market capitalisation of R1501m-R2000m were statistically different to those with a market capitalization of R0-R250m and R251m-R500m. All other size categories were not statistically different in terms of derivative usage.

4.5 Research question 5

What is the effect of industry differentiation on derivative usage?

Within each country, the respective companies were grouped into industry sectors according to the Reuters DataStream classifications. Thereafter the results were analysed graphically and then analysed statistically in order to identify whether or not significant differences exists between the respective industry sectors.

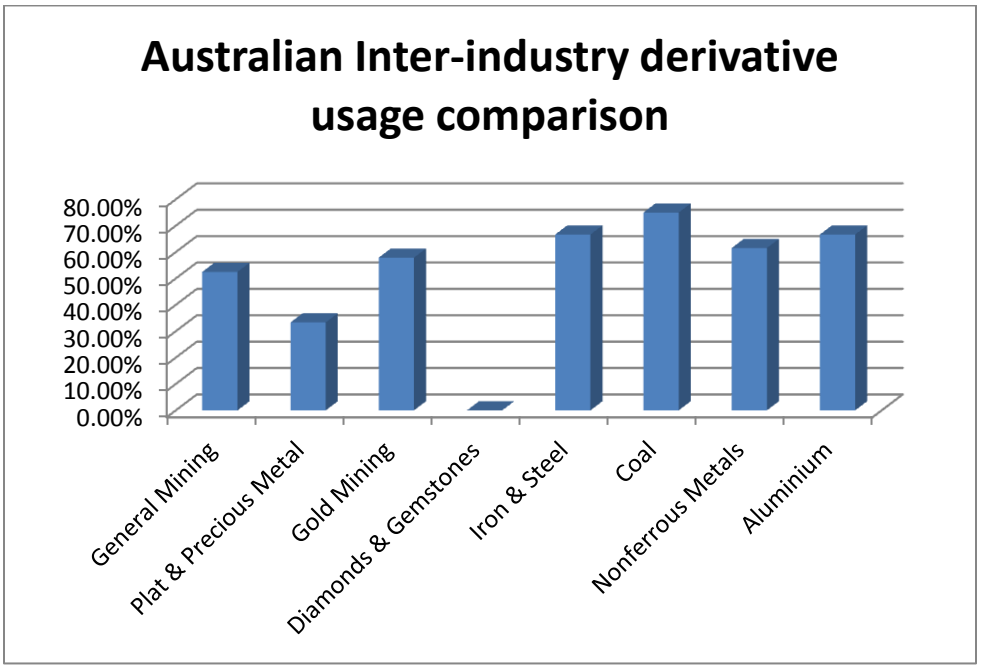
4.5.1 Graphical Results for South African by Mining Subsector:



The respective companies within each DataStream industry sector are detailed in Annexure A. The results obtained were as follows: 43% of JSE listed General Mining firms used some form of derivative, 57% did not. 60% of JSE listed Platinum and Precious Metal mining firms used some form of derivative, 40% did not. 22% of JSE listed Gold Mining firms used some form of derivative, 78% did not. 20% of JSE listed Diamonds and Gemstone mining firms used some form of derivative, 80% did not.71% of JSE listed Iron and Steel firms used some form of derivative, 29% did not. 0% of JSE listed Coal Mining firms used some form of derivative, 100% did not.100% of JSE listed Nonferrous Metals mining firms used some form of derivative, 0% did not.100% of JSE listed Aluminium mining firms used some form of derivative, 0% did not. One must bear in mind that given the relatively smaller sample size of 46 mining companies listed on the JSE, results may be influenced to some extent.

The implications of the results above will be discussed below after the statistical results of the industry differences are presented.

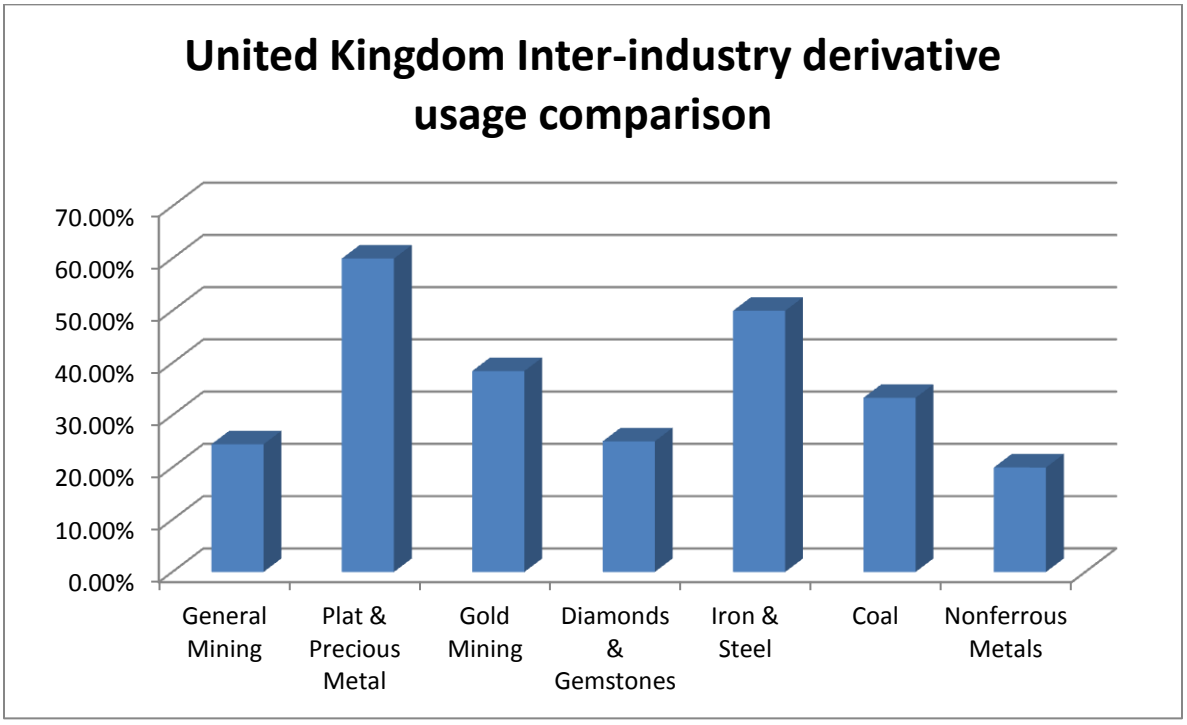
4.5.2 Graphical Results for Australia by Mining Subsector



52% of ASX listed General Mining firms used some form of derivative, 48% did not. 33% of ASX listed Platinum and Precious Metal mining firms used some form of derivative, 67% did not. 58% of ASX listed Gold Mining firms used some form of derivative, 42% did not.0% of ASX listed Diamonds and Gemstone mining firms used some form of derivative, 100% did not. 67% of ASX listed Iron and Steel mining firms used some form of derivative, 33% did not. 75% of ASX listed Coal Mining firms used some form of derivative, 25% did not. 62% of ASX listed Nonferrous Metals mining firms used some form of derivative, 38% did not. 67% of ASX listed Aluminium Mining firms used some form of derivative, 33% did not.

The implications of the results above will be discussed below after the statistical results of the industry differences are presented.

4.5.3 Graphical Results for the United Kingdom by Mining Subsector



24% of LSE listed General Mining firms used some form of derivative, 76% did not. 60% of LSE listed Platinum and Precious Metal mining firms used some form of derivative, 40% did not. 38% of LSE listed Gold Mining firms used some form of derivative, 62% did not. 25% of LSE listed Diamonds and Gemstone Mining firms used some form of derivative, 75% did not. 50% of LSE listed Iron and Steel mining firms used some form of derivative, 50% did not. 33% of LSE listed Coal Mining firms used some form of derivative, 67% did not.20% of LSE listed Nonferrous Metals mining firms used some form of derivative, 80% did not. The implications of the results above will be discussed below after the statistical results of the industry differences are presented.

Empirical Research Findings:

Statistical test were performed within each country between the different mining sub-sector categories in order to identify whether or not statistically significant differences in derivative usage exists. The results can be found below:

4.5.4 Statistical Results: RSA Internal differences between Mining subsectors:

Industry Differences and Derivative Usage			
South Africa	**Pearson Chi-Square**	**Asymp. Sig.(2 sided)**	**Statistically different at 5% level?**
General Mining vs Plat & Precious Metals	0.148	0.701	No
General Mining vs Gold Mining	1.775	0.183	No
General Mining vs Diamonds & Gemstones	0.148	0.701	No
General Mining vs Iron & Steel	0.875	0.350	No
General Mining vs Coal	2.550	0.110	No
General Mining vs Nonferrous Metals	1.778	0.182	No
General Mining vs Aluminium	0.938	0.333	No
Plat & Precious Metals vs Gold Mining	1.998	0.158	No
Plat & Precious Metals vs Diamonds & Gemstones	0.400	0.527	No
Plat & Precious Metals vs Iron & Steel	0.171	0.679	No

Plat & Precious Metals vs Coal	2.880	0.090	No
Plat & Precious Metals vs Nonferrous Metals	1.120	0.290	No
Plat & Precious Metals vs Aluminium	0.600	0.439	No
Gold Mining vs Diamonds & Gemstones	0.498	0.480	No
Gold Mining vs iron & Steel	3.874	0.049	**Yes**
Gold Mining vs Coal	0.800	0.371	No
Gold Mining vs Nonferrous Metals	4.278	0.039	**Yes**
Gold Mining vs Aluminium	2.593	0.107	No
Diamonds & Gemstones vs Iron & Steel	1.185	0.276	No
Diamonds & Gemstones vs Coal	1.600	0.206	No
Diamonds & Gemstones vs Nonferrous Metals	2.100	0.147	No
Diamonds & Gemstones vs Aluminium	1.200	0.273	No
Iron & Steel vs Coal	4.286	0.038	**Yes**
Iron & Nonferrous Metals	0.735	0.391	No

Iron & Steel vs Aluminium	0.381	0.537	No
Coal vs Nonferrous Metals	5.000	0.025	**Yes**
Coal vs Aluminium	4.000	0.046	**Yes**
Nonferrous Metals vs Aluminium	0.412	0.517	No

Within South Africa, there was a statistical difference in derivative usage between Gold Mining vs Nonferrous Metals, Iron & Steel vs Coal, Coal vs Nonferrous Metals, Coal vs Aluminium.

Conclusion: South African differences between Mining subsectors.

It is imperative to note that insufficient sample sizes of companies in particular subsectors will tend to skew the results obtained. In particular in South Africa- Coal, Non ferrous Metals and Aluminium samples with 3, 2 and 1 companies respectively cannot reliably represent be seen to represent any particular trends. As such, statistical findings implying significant differences between the respective industry subsectors derivative usage rates are not meaningful. On a similar note, the graphical results illustrating 0%, 100% and 100% derivative usage rates of Coal, Non Ferrous metals and Aluminum companies have negligible implications. It is however perplexing that in spite of significant graphical discrepancies between the other industry subsectors there are no significant statistical differences at a 5% significance level.

4.5.5 Statistical Results: Australian Internal differences between Mining subsectors:

Industry Differences and Derivative Usage			
Australia	**Pearson Chi-Square**	**Asymp. Sig.(2 sided)**	**Statistically different at 5% level?**
General Mining vs Plat & Precious Metals	0.410	0.522	No
General Mining vs Gold Mining	0.151	0.698	No
General Mining vs Diamonds & Gemstones	1.076	0.300	No
General Mining vs Iron & Steel	0.596	0.440	No
General Mining vs Coal	1.915	0.166	No
General Mining vs Nonferrous Metals	0.323	0.570	No
General Mining vs Aluminium	0.225	0.635	No
Plat & Precious Metals vs Gold Mining	0.630	0.427	No
Plat & Precious Metals vs Diamonds & Gemstones	0.444	0.505	No
Plat & Precious Metals vs Iron & Steel	1.029	0.310	No

Plat & Precious Metals vs Coal	1.875	0.171	No
Plat & Precious Metals vs Nonferrous Metals	0.788	0.375	No
Plat & Precious Metals vs Aluminium	0.667	0.414	No
Gold Mining vs Diamonds & Gemstones	1.287	0.257	No
Gold Mining vs iron & Steel	0.197	0.657	No
Gold Mining vs Coal	0.940	0.332	No
Gold Mining vs Nonferrous Metals	0.042	0.837	No
Gold Mining vs Aluminium	0.082	0.774	No
Diamonds & Gemstones vs Iron & Steel	1.667	0.197	No
Diamonds & Gemstones vs Coal	2.438	0.118	No
Diamonds & Gemstones vs Nonferrous Metals	1.436	0.231	No
Diamonds & Gemstones vs Aluminium	1.333	0.248	No
Iron & Steel vs Coal	0.175	0.676	No
Iron & Nonferrous Metals	0.060	0.806	No

Iron & Steel vs Aluminium	0.000	1.000	No
Coal vs Nonferrous Metals	0.520	0.471	No
Coal vs Aluminium	0.085	0.770	No
Nonferrous Metals vs Aluminium	0.027	0.869	No

Within Australia, there were no statistical differences in derivative usage between any of the industry sectors.

Conclusion: Australian differences between Mining subsectors.

It is imperative to note that insufficient sample sizes of companies in particular subsectors will tend to skew the results obtained. In particular in Australia- Platinum and Precious Metals, Diamonds and Gemstones and Aluminium with samples sizes of 3, 1 and 3 companies respectively cannot reliably be seen to represent any particular trends.

As such, statistical findings implying no significant differences between the respective industry subsectors derivative usage rates are not meaningful. On a similar note, the graphical results illustrating 33%, 0% and 67% derivative usage rates of Platinum and Precious Metals, Diamonds and Gemstones and Aluminum companies have negligible implications. It is however perplexing that in spite of significant graphical discrepancies between the other industry subsectors there are no significant statistical differences.

4.5.6 Statistical Results: United Kingdom Internal differences between Mining subsectors:

Industry Differences and Derivative Usage			
United Kingdom	**Pearson Chi-Square**	**Asymp. Sig.(2 sided)**	**Statistically different at 5% level?**
General Mining vs Plat & Precious Metals	2.695	0.101	No
General Mining vs Gold Mining	1.410	0.235	No
General Mining vs Diamonds & Gemstones	0.000	1.000	No
General Mining vs Iron & Steel	0.620	0.431	No
General Mining vs Coal	0.267	0.605	No
General Mining vs Nonferrous Metals	0.201	0.654	No
Plat & Precious Metals vs Gold Mining	0.799	0.371	No
Plat & Precious Metals vs Diamonds & Gemstones	1.593	0.207	No
Plat & Precious Metals vs Iron & Steel	0.058	0.809	No
Plat & Precious Metals vs Coal	0.933	0.334	No

Plat & Precious Metals vs Nonferrous Metals	2.213	0.137	No
Gold Mining vs Diamonds & Gemstones	0.485	0.486	No
Gold Mining vs iron & Steel	0.104	0.747	No
Gold Mining vs Coal	0.075	0.784	No
Gold Mining vs Nonferrous Metals	1.027	0.311	No
Diamonds & Gemstones vs Iron & Steel	0.476	0.490	No
Diamonds & Gemstones vs Coal	0.142	0.707	No
Diamonds & Gemstones vs Nonferrous Metals	0.141	0.707	No
Iron & Steel vs Coal	0.196	0.658	No
Iron & Nonferrous Metals	0.889	0.346	No
Coal vs Nonferrous Metals	0.511	0.475	No

Within the United Kingdom, there were no statistical differences in derivative usage between any of the industry sectors.

Conclusion: United Kingdom differences between Mining subsectors

It is imperative to note that insufficient sample sizes of companies in particular subsectors will tend to skew the results obtained. In particular in the United Kingdom- Platinum and Precious Metals, Iron and

Steel, Non Ferrous Metals and Aluminium with samples sizes of 5,2, 5 and 0 companies respectively cannot reliably represent be seen to represent any particular trends.

As such, statistical findings implying no significant differences between the respective industry subsectors derivative usage rates are not meaningful. On a similar note, the graphical results illustrating 60%, 50% and 20% derivative usage rates of Platinum and Precious Metals, Iron and Steel and Non Ferrous Metals companies have negligible implications. It is however perplexing that in spite of significant graphical discrepancies between the other industry subsectors there are no significant statistical differences.

4.5.7 Overall Conclusion: Quantitative Results

An illiquid or nonexistent spot market is the predominant suspected differentiating factor for discrepancies between industry subsectors. Further discussion of this subject will be dealt with in the qualitative results. Fundamentally however, there is a notable absence of a spot market for the following commodities:

1. Diamonds and Gemstones
2. Iron ore

As such one would expect the derivative usage rates for companies the aforementioned subsectors to be lower than the other industry subsectors. The results obtained in the South African graphical results are in line with this expectation in respect of Diamonds and Gemstones subsector with a derivative usage rate of 20%. The 20% would assumedly represent currency and interest rate derivatives. In the Australian sample there is a notable absence of companies in the Diamonds and Gemstones sector. In the UK sample 25% of companies in the Diamonds and Gemstones sector utilise derivatives, this is in line with the South African results.

In terms of the Iron and Steel sector, the South African had a derivative usage rate of 71%. The Australian sample had a usage rate of 67% and the United Kingdom sample with a sample size of 2 had a usage rate of 50%. There are two possible explanations for this anomaly, either the Steel companies with the established spot market resulted in the high usage rates or alternatively significant interest rate and currency derivatives were employed by the respective companies within the subsector.

The balance of the subsectors had usage rates in line with the country usage rates. This is in line with expectations.

Chapter 5: Qualitative Findings

5. Introduction

In this chapter, the findings of the qualitative interviews will be discussed. The chapter presents the themes that emerged from the interviews and then expounds on the various schools of thought from the interviewees' perspectives. The quantitative results and qualitative results relating to the research questions are then critically compared with the findings of prior studies relating to hedging in the mining industry, in order to provide an overview on the significance of the findings. The chapter finally concludes with an overview of the qualitative results relating to hedging in the mining industry obtained through the interviews.

5.1. Analysis of Qualitative data:

In the following section is an analysis of the four qualitative interviews conducted with South African participants: A, B, C, and D, who were chosen using a non probability judgment sampling method. Interviews, based on a review of the quantitative data and an open-ended question to solicit participants' views on derivative usage were conducted. Notes were made during the interviews and this data were then read over several times by the researcher to develop a sense of similar themes that emerged during the conversations. The data from each of the four interviews, relating to each theme were then combined, in order to allow the researcher to compare and contrast the participants' opinions on each topic.

The general themes that emerged from the data are:

(a) Derivative types
(b) Options versus forwards
(c) Differences in size
(d) Country differences
(e) Differences in sectors
(f) Distinct purposes of derivatives usage
    (i) Purpose 1: Commercial hedging since 1760s
    (ii) Purpose 2: Hedging for balance sheet and income statement purposes

(g) Hedging of by-products

(h) When it is appropriate to use derivatives

(i) Banker's profit from hedging

(j) Long term hedging

(k) Other general comments

(a) Derivative types:

According to B, the two most popular items that are hedged are generally currency and commodities; however, the hedging purposes are generally divergent. Currency hedging is generally a short term hedge used to cover input costs, or alternatively, to ensure margins on an export order.

Commodity hedging is the more interesting of the two hedges. According to B, there are not too many groups left with substantial hedge books in South Africa. Exceptions to the rule include Sasol, Anglogold, Angloplat and Metorex. However, Angloplat's substantial hedge involves a by-product of their platinum production, rhodium, whereas Metorex are forced to hedge by the banks as a result of their substantial debt ratio.

(b) Options versus forwards:

Companies tend to be more inclined to use options over forwards, with put options being the most desired derivative for mining companies. However, given the substantial cost of put options, most mining companies tend towards using zero cost collars, which limit downside as well as upside. This is rebutted by C, who was of the opinion that mining companies are indifferent to using forwards or options, and in fact, cost considerations are far more important than the use of a particular derivative. Puts do not involve production risks whilst forwards do. Put eliminate the financial burden experienced by mining companies who run into production problems and have entered into a forward. A put is a true hedge and it may be more expensive for this reason.

(c) Differences in size:

B is of the view that there exists a positive relationship between the size of the company and the derivative usage in the company. This is attributable to the fact that as a firm size grows larger, so the

treasuries at the mining company become increasingly sophisticated and larger. Short term currency hedging management is a pertinent example of something that will tend to grow with firm size.

C, however, noted that there should theoretically be a directly proportional relationship between revenue size and the proportion of the hedging. Hedging programmes require expertise that is fundamentally too costly for the smaller miners. This point is corroborated in the graphical results between firm size and derivative usage.

(d) Country differences:

South Africa tends to be a mature mining industry with primary outputs of gold, platinum and coal. According to B, whilst platinum output going forward should experience small annual growth, coal production should remain relatively stable and gold production will inevitably decline. In sharp contrast, there are far more exploratory mining companies listed on the ASX and TSX with a range of different commodities and far more interesting capital structures. As such, there will inevitably be differences between hedging practices, albeit small differences. According to C, this is not so. C noted the tendency for most hedging to be bank-demanded. As a result, according to C, very similar international banking legislation should result in very similar hedging patterns.

When questioned on a justification for the discrepancy in exploratory mining companies, B suggested that the primary investors played a major role. The South African market is dominated by pension investors who are inherently risk-averse. Contrary to this, the TSX is dominated by retail investors with more of a risk appetite. Furthermore the significant tax breaks offered by the TSX, allowing tax deductions for exploration expenditure, are highly attractive.

According to B, another suggestion to explain possible country differences in results stems from the fact that South Africa has a far more volatile currency than the comparable countries; hence, the tendency for South African mining companies is to “take a view.” South Africa has the most liquid currency amongst the emerging nations. This is corroborated by C, who stated that the rand is the primary concern for South African mining companies. In C’s opinion, the rand could possibly go to R25/$, so it would be wise not to hedge ZAR per oz. For this to happen, however, the local economic conditions would need to be dire and the political issues would be dramatic so that a gain could be offset by legislative, economic and political problems for business.

A more humorous view on the country difference issue was held by D, who stated that In terms of Australian mining companies, many mining companies there were particularly keen to speculate with derivatives, noting how akin the experience was to a day at the racecourse. The allusion here is that a racecourse punter does not win consistently- but enjoys the experience thoroughly. Mining is like an option, and volatility adds value - this is relatively true for exploratory mining companies which often do not have much debt for this reason.

(e) Differences in sectors:

In B's opinion, there are significant differences inherent in the different mining sectors: this is predominantly due to either an illiquid or nonexistent spot market. For example, iron ore producers cannot hedge in the absence of a liquid market. Iron ore tends to be dominated by fixed price contracts. There tend to be conflict between selling at spot and at fixed prices which creates interesting scenarios for hedging in this sector if prices are fixed The other interesting aspect about iron ore is that there are only four major suppliers of export iron ore which means there is a concentration of supply - like platinum. In contrast, the coal market is very liquid as it has been for the last decade; hence, this increases the ease of a proposed hedging. Base metals, like coal, are very easy to hedge. Diamonds however, are impossible to hedge, given the non-commodity nature of a diamond. It is further interesting to note that for South African and Australia, the currency may follow resources prices so that there may be a natural hedge in place.

An argument offered by C, in terms of why there have been changes over time in derivatives usage, relates to the liquidity in a particular environment. There was a notable absence of a platinum futures market ten years ago, whereas a highly liquid market now exists.

(f) Distinct Purposes of derivative usage

According to D, it is crucial to differentiate between the two distinct purposes in the hedging saga:

(i) Purpose 1: Commercial hedging since the 1760s

Traditionally, there has always been hedging in the dispatching of concentrates. Once the commodity has been extracted from the ground, at the point of shipping generally, 80% of the payment is payable. Two to three months later, the balance of 20% is then made to settle the outstanding balance. According to D, there are and have been many mining companies who see this potential fluctuation of

the 20% balance as a substantial risk. In this instance there is a clear pricing issue that possibly requires hedging; as such, many mining companies hedge this specific risk.

B stated that it is fundamental to distinguish between short term hedging and long term hedging. Short term hedging to ensure predictable cash flows is not in his opinion a concern. For example, SASOL take out currency forwards for a specific item, in order to lock in a specific price- this is not "true hedging" in a sense.

Major mining companies, such as Anglo and BHP, generally will say they are not hedgers. This term hedgers needs to be refined as it refers specifically to long term commodity forward sales rather than forex and interest rate swaps derivatives usage. The results obtained corroborate the distinction.

(iii) Purpose 2: Hedging for balance sheet and income statement purposes

D is of the opinion that purpose two deals primarily with the marketing of current production; it is this specific purpose which raises many questions.

Under this heading, there are two fundamentally different time periods which need to be contrasted. Phase 1 covers the 1980s and 1990s, and Phase 2 covers 2000 to the present.

- **Phase 1: 1980s and 1990s**

The first time period covers the 1980s and 1990s, leading up to the year 2000. D's reasons for identifying this specific period will be discussed below. It was during this phase that Peter Munk, chairman and founder of the mining company Barrick Gold, the world's largest gold-mining corporation was hailed as a "conquering hero to shareholders.[21] Munk, at one stage, had a 12m oz gold hedge in place. According to D, bankers loved hedging and were even prepared to enter into hedges without margin. This in itself made hedging incredibly attractive. An Australian mining colleague of D's championed the option to put shorts in place.

The problem of course arises when a 10 year project could be wiped out in year two if the commodity price rallied. The benefit of a hedging using a futures market and downside of hedging using forward contacting from a company's perspective is the daily mark to market requirement. The phase was characterised by a general reduction in the gold price which in turn incentivised mines to hedge.

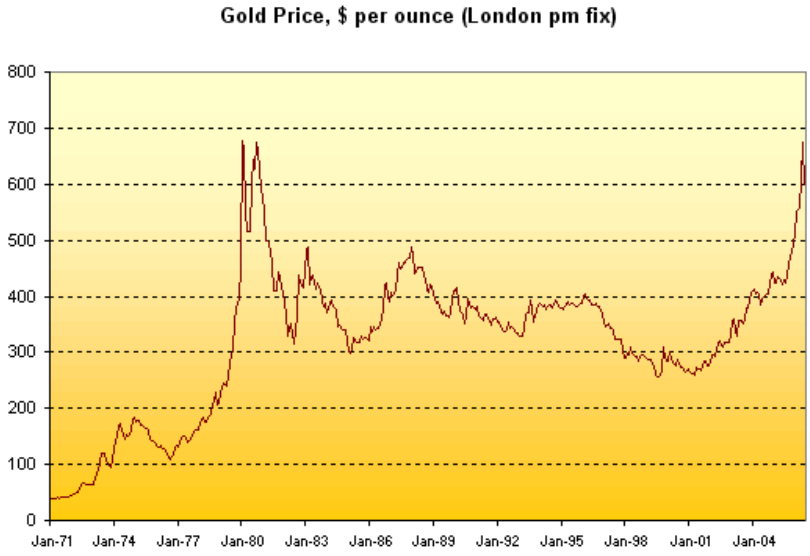
[21] Barrick Gold Annual Report. Accessed at: www.barrick.com/Theme/Barrick/files/docs.../1999_AR_en.pdf on 5/12/2010

According to D, during the 1980s and 1990s, with interest rate at a 5% level, many small open cast Australian mines' first or second years of operations were soundly financed in this fashion.

- **Phase 2: 2000 to present**

The year 2000 was a pivotal moment in hedging history in D's opinion. Africa's third largest gold producer, Ashanti Goldfields, faced huge losses from its wrong-footed bet that gold prices would continue to tumble. The news of Ashanti's dire predicament resulted in the gold price rising sharply, partly as a result of actions by other gold producers. The rise of the gold price coincided with the ending of years of central bank gold sales and gold lending in order to facilitate short selling of gold. As the Ashanti's share price tumbled and Ashanti begun crisis talks with its creditors, the commodity world began to panic. According to D, this marked the end the age old policy of hedging the gold price in the face of a perpetually decreasing gold price.

Notable casualties of hedging include Sons of Gwalia, Australia's third-largest gold producer[22] that also controlled more than half the world's production of tantalum. Hedging in this instance resulted in its August 2004 financial collapse. At the time of administration, debts exceeded $800 million as a result of falling gold reserves and hedging losses.



22World News. Accessed at: http://wn.com/Sons_of_Gwalia on 2/12/2010.

According to D, The year 2000 also marked a landmark announcement by the Bank of England, whereby Gordon Brown as Chancellor of the Exchequer sanctioned the sale of 395 tonnes of gold[23], more than half of the country's gold reserves- a move that has proved to be deeply controversial. Signalling such a large sale of bullion to gold traders, the event helped to drive the precious metal to a 20-year low. Figures released by the Treasury show that the total proceeds from the combined sales over the period 1999 to 2002, was around $3.5billion.

According to D, another major event with substantial lead on effects was the Ben Bernanke speech on November 21, 2002.

> Like gold, U.S. dollars have value only to the extent that they are strictly limited in supply. But the U.S. government has a technology, called a printing press (or, today, its electronic equivalent), that allows it to produce as many U.S. dollars as it wishes at essentially no cost. .... we conclude that, under a paper-money system, a determined government can always generate higher spending and hence positive inflation.[24]

Whilst Bernanke was not saying anything that a rational investor did not already know, the after effects proved to be substantial. In D's oppinion, the market was "spooked" and changed forever.

The effect of the combined events culminated in the end of gold as a jewellery and commodity asset and more importantly, the beginning of gold as a financial asset. D is of the view that the commodity that was $500 in 1987 and down for 13 years and had proved to be a "free lunch" for bankers was no more.

In D's opinion, compliance and risk management divisions of banks began to panic as banks essentially carried substantial risk without much upside. Margin suddenly became an issue and banks' willingness to enter into hedges stopped. Hedging still remained and still remains attractive, if only from a fees perspective.

Suddenly it was the shareholders of the underhedged mining companys that out-performed the rest of the market. This situation proved to be a nightmare for all those mining companies following the

[23] Bank of England Press Release. Accessed at: http://www.usagold.com/bankofenglandgold.html on 10/12/2010.
[24] Federal Reserve. Accessed at: http://www.federalreserve.gov/boarddocs/speeches/2002/20021121/default.htm on 10/12/2010.

conventional wisdom prior to 2000. In D's oppinion, the situation was exacerbated by the even more stringent accounting disclosures requiring the mining companies to disclose their hedging losses.

(g) Hedging of by-products

According to B, Amplats have caps and floors in place for their by-product, rhodium. This is fundamentally due to the volatility of the rhodium market. Big automobile manufacturing customers prefer the mining company to hedge their by-production, in order to improve the predictability of their cash flows.

In contrast, Metorex, being copper producers, hedge their by-product, cobalt, in the form of caps and floors. However, this is rather a cash flow defensive mechanism insisted upon by the bank in order to cover their costs within a range. The cobalt market is incredibly volatile; in addition, the market is small with substantial potential for the use of the by-product in the Democratic Republic of Congo. Hence, a cap and floor is good protection against any eventuality, in spite of giving up some upside.

(h) When is the use of derivatives appropriate?

B alluded to a practice of using derivatives to pre-finance a mine's capital costs, particularly in the gold mining industry. With the first three years of a mine being the most fundamental to its future success, there is no objection at large to any form of hedging in this instance, be it currency and or commodity hedging.

According to B, investing in commodities is inherently volatile; in order to protect downside, mining operators must give up upside: this is the premise of hedging. For example, if I want to ensure $1000 per oz of gold sold, whilst I hedge my downside risk, I also forego the benefit of any subsequent rise in the price of gold above $1000. However, investors are not fundamentally looking for a mining company to take out the volatility; hence, the aversion to potentially capping the upside, i.e., hedging.

B further elaborated on acceptable circumstances for hedging: in his opinion, mining companies may hedge, provided they are clear on what they want to achieve, their approach is consistent, and provided that they know why they are actually hedging. If mining companies are just "playing the market", then they deserve the punishment: historically, the punishment has been dished out generously.

According to C, hedging production in the preliminary stages of the mine is perfectly acceptable. Banks often prefer the concept of introducing equity, as opposed to introducing hedging. Fundamentally, hedging 50% of production is not frowned upon in order to ensure that the costs are covered to some extent for the initial start-up period.

According to A, in the case of an under-capitalised company with a good gold property that can make money within the $400-$500 per oz range, it may be appropriate to sell gold forward. In this instance, a company can productively use the cash in order to meet loan repayments etc. Typically, such startups would tend to triple or quadruple production in a three to four year time frame, and in this particular instance, hedging their current production would be advisable. According to D, in essence, the theory is similar to that of Michael Milken's. Milken solved an inability for a weak and perhaps risky venture to acquire financing through the creation of a junk bond market; similarly, hedging can solve the inability of a weak mining company to generate necessary finance.

(i) Bankers profit from the hedging

The participants in the study were unanimous in their in the view that bankers will always profit from the hedging relationship. Essentially one must ask: why were the banks so interested in taking a long position with no margin requirements? The answer according to D, lies in the fact that the bankers, in addition to lucrative initiating fees, were consistently generating regular fees for the bank. Goldman Sachs for example have been heavily criticised for their role in the Ashanti debacle.

> Not only did Goldman reputedly advise Ashanti Goldfields to sell its gold forward at gold's low point back at the end of the 1990s, a move that brought Ashanti close to bankruptcy, and eventually leading to its takeover by Anglogold. But many commentators have suggested that Goldman profited on every angle of the Ashanti hedging debacle in addition to the sale of one of its clients to another.[25]

According to D, the 1980s and 1990s were periods characterised by bankers making billions. Rumours of AIG making $200m on one particular 2m ounces transaction of gold were rife. There was huge peer pressure to hedge and anyone not hedging was considered to be irrational given the perpetual falling gold price. In D's opinion, from the investor's side, the large majority were very satisfied to lock in their profit margins.

[25] Mineweb. Accessed at: http://www.mineweb.com/mineweb/view/mineweb/en/page34?oid=108021&sn=Detail on 8/12/2010.

In A's opinion, there are always two parties to a hedge: the bankers, and the mining companies; and the hedge is always a zero sum game. Bankers do not lose money with hedging. As such, A is of the opinion that the mining companies will inevitably lose financially from a hedging relationship: a pertinent example is the Brett Kebble- Investec relationship.[26] A attributes the tendency of mining companies to hedge on the promises of profits from the bankers.

Ian Cockerill, the CEO of Goldfields, at the time of taking over Western Areas as CEO closed the hedge book as one of his first moves.[27] According to A, the derivative books contained so many complex instruments that no-one could actually understand, each month's derivative statements that would arrive detailing derivative jargon such as "rollover", "kickout" and "split." This, in addition to management fees etc, compounded the complexities and costs of running a hedging programme.

In A's opinion, hedging from a mining company's perspective may not be impossible, but it certainly is not a moneymaker. Warren Buffett even went so far as to refer to derivatives as "weapons of mass destruction".[28] In the case of General Re, Buffett, the acclaimed guru of investing, admitted that even he could not accurately calculate how to close the derivatives book and simply resorted to letting the derivatives slowly expire. Buffett further expounded that he would only be able to calculate if the derivatives book has made or lost money when the book was finally closed out completely.

According to A, derivatives have, as a whole, done more harm than good in the mining sector. This is primarily due to the fact that no company running a derivatives book is ever going to beat the market. One may profit for four to five consecutive years, but inevitably the sixth year inevitably will land up wiping out the cumulative gains from the programme. This point is somewhat debatable, the objective of a derivative book is generally to hedge downside risk rather than make speculative profits.

(j) Long term hedging

According to D, from an investor's point of view, hedging is "poison." In essence, post-2000 mining companies who decided to hedge at $800 dollars per ounce were locking in a loss of $200 per ounce if the gold price rallied to $1000, a once unthinkable event. The problem is further exaccerbated by the fact that gold company shareholders are buying the share as an underlying option on the gold price. Premiums on gold stocks tend to increase on the proposition that the gold price will increase in the

[26] Accessed at: http://www.miningmx.com/news/archive/485276.htm. On 15/12/2010.
[27] MiningMX. Accessed at: http://www.miningmx.com/news/gold_and_silver/598192.htm on 2/12/2010.
[28] Accessed at: http://www.fintools.com/docs/Warren%20Buffet%20on%20Derivatives.pdf. On 15/12/2010.

future; thus, if the gold mining companies hedge the optionality value, the share's optionality has no value, and as a result, the share is worthless for its desired purpose.

Hedging in the last decade was enacted in order to reduce risk. The problem is that it actually had the opposite effect. D gives the following simplistic example: If gold is at $400 per oz and mining costs are at $200 per ounce, it seems rational to sell gold forward at $400 and lock in the $200 margin. The problem is that five years later, when the market price for gold is $1300 per ounce and the mining costs have moved to $1000 per ounce, the company has locked in a loss of $600 per ounce ($1000-$400). Parkinson's Law is an inevitable rule of nature that states that as income rises, so costs will rise. In reality, a seemingly higher and more profitable gold price will result in government and labour wanting more, and this inevitably leads to cost increases. In reality, the costs per ton extracted from mines often grow faster than the rate of the increase in price per ton, eroding profit margins per ton. It is however interesting to note this problem does not arise with a put option. According to D, it is this phenomenon that undermines the process of hedging. In terms of six to twelve month hedging to cover short term known expenditures, any rational stakeholder should take no issue. However, Donald Rumsfeld cautioned against the "unknown unknowns".29 It is attempts to mitigate these "unknown unknowns" which cause the hedging disasters. In B's opinion, the mining and commodity world has far too many "moving parts" to hedge. It is interesting to note that the aforementioned phenomenon is particularly relevant in the South African gold mining sector with the depths and complexities of operating as well as the sunset nature of the industry in addition to lower ore grades.

However, what is fundamentally a potential problem with a hedge is the fact that individuals executing the hedge forget that the hedge is a "living thing". As such, the hedge needs to be managed and adjusted dynamically. Every minute of the day the hedge needs to be monitored. Finally, it is necessary to have an exit plan in place for the hedge, should the need arise to extricate oneself.

Once the risk for the particular mine hedge has been quantified, and a suitable strategy decided on, it is imperative to then retrospectively analyse: has the hedge been good, bad or indifferent? According to C, the indifferent option is a highly unlikely outcome.

According to D, Bernard Swanepoel, Harmony Gold CEO, once mentioned that the best hedge is to be a low cost producer. In A's opinion, if a hedging programme is established, the implication is that 24hrs a

[29] NATO Speech. Accessed at: http://www.nato.int/docu/speech/2002/s020606g.htm on 28/11/2010.

day, the core mining operation is not in fact the element that the business is concentrating on, and this is fundamentally the problem.

Hedging is perfectly acceptable to D, if all parties are in fact "consenting adults." If hedge funds choose to engage in hedging, that is fine. But, according to D, mining companies should not do so. In D's view, the trouble is that hedging people see hedges in accounting terms. They do not understand the risks and underrate the "unknown unknowns." The hedges are looked at in accounting terms, and not in economic terms. A trader's success stems from his ability to cut a loss and ride a profit. In D's opinion, mining executives are not traders and should refrain from trading activities.

According to A, Kelvin Williams, the marketing director for AngloGold, once claimed that AngloGold was making $10m per quarter as a result of their hedge book. According to A, $10m was equivalent to 1% of the entire portfolio. If the $10m was risk-free, then that is acceptable; however, the hedges that AngloGold had could severely curtail AngloGold's underlying business. Therefore, in A's opinion, and more specifically from AngloGold's perspective, the argument to hedge was weak. A is of the view that, as opposed to generating $10m through hedging activities, a $10m increase in profit from cutting costs, raising the grade or as a result of an increase productivity is preferable.

(k) Other general comments

In A's view, AngloGold is famous for its great ore deposits, huge balance sheet and cash rich parent Anglo American; hence, A is perplexed by their desire to hedge. When AngloGold developed their infamous hedge book in the late 1980s and early 1990s, analysts were already questioning the extremity of such a move. Half a floor in the building was developed specifically for hedging purposes in the opinion of many analysts; those involved thought they were far smarter than the mining experts.

According to C, three fundamentally different roles and reasons to hedge exist alongside three fundamentally different risks:

1. Risk manager- who is concerned with: how much risk? The risk manager aims to hedge the risks of execution and extrication of the mining company. What is fundamental to understand from a risk manager's perspective is once the hedge is in place, what are the risks of non-delivery? Can you carry over the hedge to the following year assuming insufficient production in a particular year? What are the additional costs associated with the carry-over?

2. Operations manager- the fundamental concern here is construction risk, i.e., making it all happen in terms of how to approach the mine construction. Once the mine is established, the operations manager must manage project risk in terms of ensuring the project viability throughout the process.
3. From a fund manager's perspective: he needs to manage four primary risks: construction, currency, commodity and completion risk.

C advocates four essentials for a successful hedging programme:

1. understand your commodity;
2. understand the fringe risks- i.e. speculators and traders and the effect on the commodity price;
3. take a macroeconomic view of the environment;
4. take a micro economic view on the environment.

According to C, the propensity to put on a hedge today has lessened drastically from a few years ago. The primary reason is due to the increased volatility associated with the metal market. C's view is that the world has become so instantaneous.

5.2 Concluding Remarks

The qualitative results of the four interviews illustrate clear instances of corroborative conclusions on discussions of derivatives as a risk management and cash flow smoothing tool. Howvever, vastly different opinions about derivatives as a value creation tool emerged from the interviews. The next chapter deals with the conclusions to be drawn from the results of the quantitative and qualitative analyses of the findings. Some general observations will be made regarding the overall findings of the study.

Chapter 6: Summary

6.1 Introduction

In this chapter, I shall proceed to summarise the statistical findings and qualitative results in order to develop a comprehensive response to the research questions posed in Chapter 1. I shall begin by addressing each of the research questions sequentially. Thereafter, I shall draw some general observations summarising the themes that emerged from the qualitative data.

6.2 Responses to the research questions

6.2.1 To what extent are derivatives used by firms in the mining sector in South Africa, Australia and the United Kingdom?

For mining companies listed on the JSE, 48% used one or more derivatives, 52% used no derivatives. In relation to ASX listed entities, 44% used one or more derivatives, while 56% used no derivatives. Finally for LSE listed mining companies, 29% used one or more derivatives, 71% used no derivatives. In conclusion, it appears that JSE and ASX listed companies have more similar and higher derivative usage patterns, when compared to LSE Listed entities

6.2.2 What are the similarities or differences between derivative usage in South Africa, Australia and the United Kingdom?

6.2.2.1Country differences:

At an overall derivatives usage level, there is a statistically significant difference in derivative usage between South Africa and the United Kingdom, as well as a statistically significant difference between the United Kingdom and Australia. There is no statistically significant difference between derivative usage in South Africa and Australia. These statistical findings corroborate my aforementioned insights that that JSE and ASX listed companies have more similar and higher derivative usage patterns, when compared to LSE Listed entities, in the graphical data above.

Further testing was conducted comparing groups of entities of a similar size, across different countries, in order to assess whether or not when holding company size constant there are still differences or similarities between the countries.

Companies within the size category of “market capitalisation in excess of R2 billion” were not statistically different across the three countries in terms of derivative usage. Similarly, companies within the size category of “market capitalisation between R1501m-R2000m” were not statistically different across the three countries, in terms of derivative usage. Companies within the size category of “market capitalisation between R1001m-R1500m” were also not statistically different across the three countries in terms of derivative usage. Furthermore, companies within the size category of “market capitalisation between R501m-R1000m” were not statistically different across the three countries in terms of derivative usage. Companies within the category of “market capitalisation between R251m-R500m”

were not statistically different across the three countries in terms of derivative usage. Finally, companies within the category of "market capitalisation between R0m-R250m" were not statistically different across the three countries in terms of derivative usage.

These findings are largely in conflict with the prior research findings, suggesting statically significant differences between the South Africa and United Kingdom listed companies, as well as between the Australian and United Kingdom listed companies. This apparently contradictory result may be as a result of an insufficiently large sample size within a particular size category, to calculate a statistically significant difference between two countries.

6.2.2.2 Interviews:

B's suggestion that South Africa's mature mining industry would differ significantly from the far more exploratory-prone mining companies listed on the ASX, did not in fact apply to the sample selected. C's suggestion however has merit. C suggests that because of the fact that most hedging tended to be bank-demanded, and international banking practice is consistent, similar hedging patterns worldwide would emerge. This still does not address the discrepancies between the UK and RSA, and UK and AUS.

In response to the aforementioned discrepancies, C's proposal that South Africa has a far more volatile currency than the comparable countries, leading to a tendency for South African mining companies to take a view, is indeed merit worthy. Furthermore, whilst humourous in nature, D's theory that Australian mining companies were particularly keen to hedge as a result of equating the experience to a day at the racecourse, is completely appropriate.

In conclusion, for a mining corporation, country differences do in fact play a role in determining the extent of derivatives usage. It would seem that in particular, the type of economy, e.g., in a commodity-based economy, such as South Africa and Australia, volatile currencies and the risk-seeking behavior of the companies' executives do perhaps imply an increased tendency to use derivatives.

6.2.2.3 Industry Differences:

Further statistical testing was conducted comparing groups of entities within a similar mining subsector, across different countries, in order to assess whether or not when retaining the mining subsector constant, there are still differences or similarities between the countries.

In the General mining sector, there was a statistical difference in derivatives usage between the UK and Australia, as well as between South Africa and the United Kingdom, but not between South African and Australian derivative usage. This is consistent with the overall differences and similarities at a country level.

In the Platinum and Precious metals sector, Gold mining sector, Diamonds and Gemstones sector and Iron and Steel sector there were no statistical differences in derivatives usage between the UK, Australia and South African listed companies.

In the Coal sector, there was a statistical difference in derivatives usage between South Africa and Australia. There was however no statistical difference between the UK and Australian markets. Nor was there any statistical difference between the South African and UK markets.

In the Non Ferrous metals sector, there was a statistical difference in derivatives usage between South Africa and the UK. There were no statistical differences in derivative usage between the South African and Australian companies; nor were there significant differences between the UK and Australian companies.

In the Aluminum sector, there was not any statistically significant difference in derivatives usage between South Africa and Australia. The UK listed companies top 100 by market capitalisation were notably absent of any listed companies in the Aluminium sector.

6.3 What risks are most often hedged by mining companies?

6.3.1 South Africa:

It would appear that currency forwards with a usage rate of 39% are the most predominantly used derivative in the South African market. Commodity forwards are the next most common derivative used with a usage rate of 20%. Commodity options and interest rate swaps have an identical usage rate of 13%. 11% of JSE listed mining firms used currency options. The least commonly used derivatives in South Africa are forward rate agreements with a usage rate of only 2%.

In conclusion, currency is the most commonly hedged risk by South African listed mining companies. This is followed by commodity price risk, and then finally interest rate risk.

6.3.2 Australia:

For Australian listed companies, the most commonly used derivative is the currency forward with a usage rate of 26%. Currency options with a usage rate of 9% are one of the least commonly used derivatives by Australian listed companies. The second most popular derivatives used are commodity forwards with a usage rate of 21%. Similarly, commodity options are commonly used with a usage rate of 20%. In terms of interest rate risk, an interest rate swap usage rate of 10% and a forward rate agreement usage rate of 0% suggest that interest rate risk is not perceived to be significant by Australian listed companies. On a simplistic cumulative basis, it would appear that commodity price risk (21% + 20%) is ostensibly more risky than currency (26% + 9%) risk which is more risky than interest rate risk for an Australian listed entity. This result seems plausible for a mining entity located in a country with historically minimal currency volatility.

6.3.3 United Kingdom:

For the UK listed mining companies, commodity forwards with a usage rate of 16% were the most commonly used derivative. Currency forwards were the next most popular derivative with a usage rate

of 13%. Commodity options and interest rate swaps with usage rates of 7% and 6% respectively were the next most utilised derivatives. Currency options were only used by 1% of the UK listed mining corporations, and finally 0% of the UK listed entities used forward rate agreements. In conclusion, forwards contracts were more extensively and widely used than options. It would appear that commodity price risk and currency risk were equally the most hedged risks by UK listed mining companies. Interest rate risk was the least commonly hedged risk of the three risks.

6.3.4 Interviews:

B's theory that, currency and commodities are the two most popular items that are hedged is substantiated by the graphical data. There is insufficient data information, however, to identify whether or not the hedges are in fact short or long term in nature.

In terms of B's proposition relating to companies' preference to use options, as opposed to forwards, is not supported by the data. C's theory that mining companies are in fact indifferent to using forwards or options, and that cost considerations are the key factor seems highly plausible.

In conclusion, commodity and currency risk appear to be far more highly hedged using derivatives than interest rate risk. There is little support for the hypothesis that forwards are favoured over options or vice versa. Whilst not conclusive, this gives credence to the suggestion that derivative cost is indeed the overarching factor in terms of whether to use options or forwards.

6.4 What is the effect of firm size and derivatives usage?

Size Differences:

To address the research question relating to whether there are size differences that explain derivative usage differences, each of the size categories was compared to see if there are statistically significant differences.

6.4.1 South Africa:

In the South African size comparison, only difference between size categories: companies with a market capitalisation exceeding R2 billion, and those with a market capitalisation of R0–R250 million, were statistically different in terms of their derivative usage. In all other size categories, there were no statistically significant differences in derivative usage. It would appear that there is some credence in the interviewees' responses that it is only the larger firms that can feasibly have viable derivative programmes, due to the excessive implementation costs involved for a mining firm when instituting a successful derivatives programme.

6.4.2 United Kingdom:

In the United Kingdom size comparison, companies with a market capitalisation exceeding R2 billion, compared to those with a market capitalisation of R1000m-R501m, R251m-R500m and R250m–R0m were statistically different in terms of their derivative usage. Furthermore, companies with a market

capitalisation of R1501m-R2000m were statistically different to those with a market capitalisation of R0-R250m and R251m-R500m. All other size categories did not exhibit a statistically significant difference in terms of derivative usage. In conclusion, it would appear that the aforementioned pattern, as suggested by the interviewees, that only the larger firms can afford substantial derivative programmes is supported by the statistical data.

6.4.3 Australia:

The comparatively small number of size categories in the Australian sample is due to the fact that the top 100 Australian companies, ranked by market capitalisation, all had market capitalisations in excess of R1bn. In the Australian size comparison, companies with a market capitalisation exceeding R2 billion compared to those with a market capitalisation of R1501m-R2000m, and R1001m–R1500 million were statistically different in terms of their derivative usage. All other size categories were not statistically different in terms of derivative usage. In conclusion, these results seem to confirm yet again the hypotheses put forward by the interviewees.

6.4.4. Interviews:

B's suggestion that firm size and derivative usage are positively related, as a result of increasingly sophisticated and larger treasuries, seems highly credible. In conclusion, the data would indeed suggest that growth in firm size does in fact seem to predicate an increase in derivative usage. The key issue of such a finding is whether or not increased derivative usage creates value or not: this is however not a question that was researched in this study.

6.5 What is the effect of industry differentiation on derivative usage?

6.5.1 South Africa

South African mining subsector derivative usage rates were highest in Iron and Steel firms, with a usage rate of 71% respectively. This is in sharp contrast to both JSE listed Coal mining firms, nonferrous metal mining firms, as well as Aluminium mining firms, with usage rates of 0%. 43% of JSE listed General mining firms used some form of derivative. 60% of JSE listed Platinum and Precious metal mining firms used some form of derivative. 22% of JSE listed Gold mining firms used some form of derivative. 20% of JSE listed diamonds and gemstone mining firms used some form of derivative.

Unlike the ASX and LSE listed mining firms, there are statistically significant differences between particular JSE listed mining subsectors. Within South Africa, there were significant statistical differences in derivative usage between the Gold sector mining compared to the nonferrous metals sector, and the iron and steel sector compared to the Coal sector. In all other sectors, there were no statistically significant differences in derivative usage.

6.5.2 Australia:

In terms of the Australian listed entities, derivative usage rates between the different mining subsectors differed significantly. Thus it was ironic that there were no statistical significant differences in derivative

usage between any of the industry sectors. This anomaly can only be attributed to the small sample size in the respective mining subsectors.

In terms of usage rates, the highest derivative usage rate was found in ASX listed Aluminium mining firms, with a usage rate of 67%. 0% of ASX listed diamonds and gemstone mining firms used derivatives. This seems plausible, given the lack of a commodity hedging market for Diamonds and Gemstones. 52% of ASX listed General mining firms used some form of derivative. 33% of ASX listed Platinum and Precious metal mining firms used some form of derivative. 58% of ASX listed gold mining firms used some form of derivative. 7% of ASX listed Iron and Steel mining firms used some form of derivative. 75% of ASX listed Coal mining firms used some form of derivative, and finally 62% of ASX listed nonferrous metals mining firms used some form of derivative. These results, taken at face value, would indeed suggest that significant differences do exist between different mining subsectors, in spite of the fact that there is insufficient statistical support for this statement.

6.5.3 United Kingdom:

Of the UK listed mining companies, there appears to be a trend of derivative usage rates between the different mining sectors in the range of 20%-60%. Platinum and Precious metal mining firms with a derivative usage rate of 60% topped the list; while LSE listed nonferrous metal mining companies are at the bottom of the list with the 20% usage rate. 24% of LSE listed General mining firms used some form of derivative. 38% of LSE listed Gold mining firms used some form of derivative. 25% of LSE listed diamond and gemstone mining firms used some form of derivative. 50% of LSE listed Iron and Steel mining firms used some form of derivative, and finally 33% of LSE listed Coal mining firms used some form of derivative. It would appear superficially that UK listed entities as a whole have far more similar derivative usage rates between the different mining subsectors than South African or Australian companies amongst the various mining subsectors.

It is important to note that statistically, there were no significant differences in derivative usage between any of the industry sectors. This is possibly due to the fact that particular mining subsectors had insufficiently large mining subsector sample sizes to facilitate a statistically significant difference.

6.5.4 Interviews:

B's suggestion that significant differences do in fact exist due to either an illiquid or nonexistent spot market has substantial merit. However, whilst iron ore producers and diamond producers cannot hedge in the absence of a spot market, there are in fact no limits on their ability to hedge out currency, bi-product commodity, or interest rate risk. Furthermore, whilst the Coal market may be very liquid, suggesting an increase in Coal mining company hedging activity, the JSE population of Coal mining companies had a 0% derivative usage rate.

C's suggestion that derivatives usage rates change over time seems plausible; however, given the static nature of the data it is not impossible to prove or disprove. In conclusion, it would indeed appear that differences do exist between the various mining subsectors. There is little doubt that this is directly as a result of the fact that certain commodities do not have a spot market within which to hedge.

6.6 Concluding remarks:

In conclusion, the results quantitatively and qualitatively when analysed together yield some interesting conclusions particularly with regards to the elements refuting prior research findings. Whilst some research questions are left largely inconclusive, they do suggest areas for possible future research.

Chapter 7: Conclusion

7.1 Introduction

In this concluding chapter, I shall present a brief summary of the problem, the main findings and the discussion, in addition to highlighting the contribution to the body of existing research. The chapter further suggests possible avenues for future research in this area. Finally the chapter concludes with implications for researchers working in this field.

7.2 Conclusions from the study:

The study attempted to address the following research questions: to what extent derivatives are used by firms in the mining sector in South Africa, Australia and the United Kingdom, the similarities or differences between derivative usage in mining companies in South Africa, Australia and the United Kingdom; the risks most often hedged by mining companies, as well as the effect of firm size and derivatives usage in the mining sector, and the effect of industry differentiation on derivative usage in the mining sector.

In relation to derivative usage in the mining sector, the results would overwhelmingly suggest that derivatives are indeed prevalent to the sector across all three countries. Derivative usage rates indeed differ across the three regions.

From the perspective of similarities or differences between derivative usage in the three regions, South Africa and Australia were largely similar in their derivative usage rates. Both of the aforementioned countries however differed from the UK listed entities in terms of usage rates. It would appear that derivative usage rates were in fact higher for the two mining-driven economies, i.e., South Africa and Australia, than they were for the United Kingdom listed entities.

Comparing listed entities' derivative usage, classified into size categories, across the three countries respectively, no statistically significant differences were present. However, insufficient sample sizes may be to blame for this anomaly. This would indeed suggest a possible avenue for future research within countries with a larger population of listed mining entities perhaps a study encompassing the Toronto Stock Exchange(TSX). The fact that derivative usage across the three countries within the respective size categories did not differ statistically may be due to similar international banking practices worldwide resulting in similar derivative usage patterns.

Within each country, entities were further classified into subsector categories and then compared across the countries, e.g. General mining, Coal mining, Gold mining, etc. Results were widespread. General mining, being the largest subsector across the various countries, replicated the results for the countries as a whole, i.e., the United Kingdom differed from South Africa and Australia, which were both similar. Across the other subsectors, results varied significantly, resulting in largely inconclusive findings,

possibly as a result of insufficient sample sizes. Once more, future research in countries with larger populations of listed mining entities could yield interesting conclusions.

In terms of risks hedged, currency and commodity derivatives were far more prevalent than interest rate derivatives. This is significantly different to conventional findings suggesting interest rate derivatives as being the most widely used. It is important to note that this study did not attempt to distinguish between long term and short term hedges, which is certainly an area for further research.

In terms of derivative instruments, the study did not find any significant preference for forwards or options; cost considerations according to the interviewees, are in fact the key distinguishing factor between instrument types.

Entities within each country were compared across the size categories to identify the relationship between size and derivative usage. Generally, there appear to be statistically significant differences between entities within the largest size categories and entities within the smallest size categories. Interviewees attribute the trend to the fact that only the larger firms can feasibly have viable derivative programmes, due to the excessive implementation costs involved for a mining firm when instituting a successful derivatives programme.

In terms of industry subsector differences within each country, the results were highly varied. It would appear that these differences are possibly due to an illiquid or nonexistent spot market for certain industries i.e. diamonds and gemstones.

Whilst fascinating in theory and findings, the study does not attempt to quantify the issue of a derivative as a value creation tool; however, interviewee comments addressed the issue directly. Warren Buffet in his March 8, 2003 letter to Berkshire Hathaway Shareholders describes derivatives as "financial weapons of mass destruction[30]". It is interesting to note that the overwhelming response from interviewees engaged in the mining industry was to support the notion that long term hedging for mining companies will indeed result in their ultimate demise. However, derivatives as a tool to hedge short term cash flows, particularly for the junior mining companies with bank imposed constraints can be incredibly beneficial.

[30] BBC News. Accessed at: http://news.bbc.co.uk/2/hi/2817995.stm on 11/12/2010.

Bibliography

Alexander, R., (1996), Futures and Options: A South African Guide to Derivatives, Zebra Press, Johannesburg .

Alkebäck, P., Hagelin, N. and Pramborg, B.,(2006), 'Derivative usage by non-financial firms in Sweden in 1996 and 2003: What has changed?', Managerial Finance, Vol. 32, 2006, pp. 101–14.

Allayannis, G., & Ihrig J. , (1998), Exchange Rate Exposure and Industry Structure, University of Virginia Working Paper.

Allayannis, G., & Weston J.P., (1999), The Use of Foreign Currency Derivatives and Industry Structure, University of Virginia Working Paper.

Allayannis, G. & Weston, J.P. (2001), The Use of Foreign Currency Derivatives and Firm Market Value, The Review of Financial Studies, 14(1), 243-276.

Allayynnis, G. & Weston, J.P. (2003), Earnings Volatility, Cash Flow Volatility, and Firm Value, Working Paper, University of Virginia and Rice University.

Aretz, K. & Bartram, S.M., (2009), Corporate Hedging and Shareholder Value. Journal of Financial Research, Forthcoming. Available at SSRN: http://ssrn.com/abstract=1354149

Badrinath, S.G., Gay, G.D. & Kale, J.D. (1989): Patterns of Institutional Investment, Prudence and the Managerial "Safety Net" Hypothesis, Journal of Risk and Insurance, 56(4), 605-629.

Bartram, S.M., (2000), "Corporate Risk Management as a Lever for Shareholder Value Creation," Financial Markets, Institutions, and Instruments 9, 279–324.

Bartram, M.S., Brown, G.W. & Fehle, F.R. (2003): International Evidence on Financial Derivatives Usage, Working Paper, University of North Carolina, Chapel Hill, North Carolina.

Benson, K. & Oliver, B. (2004): Management Motivation for Using Financial Derivatives in Australia, Australian Journal of Management, 29(2), 225-242.

Berkman, H., Bradbury M. & Magan, S. (1997): An International Comparison of Derivatives Use, Financial Management, 26(4), 69-73.

Berkman, H., Bradbury, M.E., Hancock, P. & Innes, C. (2002): Derivative Financial Instrument Use in Australia, Accounting and Finance, 42(2), 97-109.

Betts, J. and K. Mamik,(2006). Optimal Hedging Decisions for Gold MIners: How Much Future Production Should a Gold Miner Forward Sell? Asia Pacific Management Conference, 163-170.

Bettis C.J., Bizjak J.M., & Lemmon, M.L (2001). "Managerial Ownership, Incentive Contracting, and the Use of Zero-Cost Collars and Equity Swaps by Corporate Insiders." Journal of Financial and Quantitative Analysis, 36, 345–370.

Block, S. & Gallagher T., (1986), The Use of Interest Rate Futures and Options by Corporate Financial Managers, Financial Management, Autumn 1986, 73-78.

Bodnar, G.M., Hayt G, Marston R. C. & Smithson C.W., (1995): Wharton Survey of Derivatives Usage by US Non-Financial firms, Financial Management, Vol. 24, No 2, 1995, p104 - p114.

Bodnar, G. M., De Jong, A. and Macrae, V., (2003) 'The impact of institutional model differences on derivatives usage: a comparative study of US and Dutch firms', European Financial Management, Vol. 9, , pp. 271–297.

Bodnar, G.M., Hayt G, Marston R., (1998), 1998 Wharton Survey of Financial Risk Management by US Non-financial Firms, Financial Management, Vol. 27, No. 4, Winter 1998, 70-91.

Bodnar G.M. & Gebhardt G., (1998), Derivatives Usage in Risk Management by US and German Non-Financial Firms: A Comparative Survey, NBER Working Paper No. 6705, http://www.nber.org.

Brown G.W., (1999), Managing Foreign Exchange Risk With Derivatives, The University of North Carolina at Chapel Hill, Version 1.5, http://itr.bschool.unc.edu/faculty/browngr.

Brown, D.M. & Toft, C.A. (1999) Molecular systematics and biogeography of the cockatoos (Psittaciformes: Cacatuidae). Auk, 116,141–157.

Callahan, M. (2002): To Hedge or Not to Hedge...That ls the Question Empirical Evidence from the North American Gold Mining Industry 1996-2000, Financial Markets, Institutions & Instruments, 11(4), 271-288.

Campbell, T. and Kracaw, W., (1990). Corporate risk management and the incentive effects of debt. J. Finance 45, pp. 1673–1686.

Carpenter, J.N. (2000): Does Option Compensation increase Managerial Risk Appetite?, The Journal of Finance, 55(5), 2311-2332.

Chamber of Mines of South Africa (2009): Annual Report.

Chang, C., (1997) , Does Hedging Aggravate or Alleviate Agency Problems? A Managerial Theory of Risk Management, University of Minnesota Working Paper.

Chowdhry, B., and Howe J.B., (1999), Corporate Risk Management for Multinational Corporations: Financial and Operational Hedging Policies, European Finance Review, Vol. 2, 229-246.

Correia, C. Holman, G. & Jahreskog A., (2006), The corporate use of derivatives: a survey of South Africa's large listed non-financial firms, South African Journal of Finance.

Cummins, J.D., Phillips, R.D. 8. Smith, S.D. (1998); The Rise of Risk Management , Federal Reserve Bank of Atlanta Economic Review, 1, 53-69.

Dadalt, P. Gay, G. and Nam, J. (2002), Asymmetric Information and Corporate Use of Derivatives, *Journal Futures Markets*, 22, 241-267.

DeMarzo, P. & Duffie, D. (1991): Corporate Financial Hedging with Proprietary Information, Journal of Economic Theory, 53(2), 261 -286.

Dionne G. & Garand, M. (2003): Risk Management Determinants Affecting Firms' Values in the Gold Mining lndustry: New Empirical Results, Economic Letters, 79(1), 43-52.

Dionne, G. & Triki, T. (2003): On Risk Management Determinants: What Does Really Work?, Working Paper, Mimeo, Risk Management Chair, HEC Montréal.

Dolde, W. (1996): Hedging, Leverage, and Primitive Risk, Journal of Financial Engineering, 4(2), 187-216.

Downie, D., McMillan, J & Nosal, E., (1996), The University of Waterloo Survey of Canadian Derivatives Use and Hedging Activities, Managing Financial Risk, Yearbook 1996, p. 214 -233. (Edited by Smithson, C.W.)

Downie, D. and Nosal E., (1998), Corporate Hedging: A Strategic Approach, University of Waterloo Working Paper.

El-Masry, A.A. (2006), ''The exchange rate exposure of UK nonfinancial companies: Industry Level Analysis'', Managerial Finance, Vol. 32, pp. 115-36.

Fang, V.K.F. & Jin T. (1999): An Empirical Study of Derivatives Usage in the Australian Gold Mining Industry, 12th Annual Australasian Finance and Banking Conference, Sydney.

Francis, J., & Stephan, J. (1993). Characteristics of hedging firms: An empirical examination. In R.W.Schwartz & C.W.SmithJr. (Eds.),Advanced strategies in financial risk management (pp. 271–281). New York, NY: New York Institute of Finance.

Froot, K., Scharfstein D & Stein J., (1993), Risk Management: Coordinating Corporate Investment and Financing Policies, The Journal of Finance, Vol. 48, No. 5, 1629-1658.

Gay, G. & Nam, J. (1998): The Underinvestment Problem and Corporate Derivatives Use, Financial Management, 27(4), 53-69.

Géczy, C. , Minton B.A., & Schrand C. , (1997), Why Firms Use Currency Derivatives, The Journal of Finance, Vol. 52, No. 4, 1323-1354

Graham, J.R., & Smith, C.W., Jr., (1999), Tax incentives to hedge, Journal of Finance 54, 2241-2262.

Graham, J.R. , & Rogers D.A. , (2000), Is Corporate Hedging Consistent with Value-Maximization? An Empirical Analysis, Fuqua School of Business, NBER Working Paper, http: //www.nber.org.

Graham, J. R. and Rogers, D. A. (2002), Do Firms Hedge in Response to Tax Incentives?. The Journal of Finance, 57: 815–839

Guay, W.R. (1999): The Impact of Derivatives on Firm Risk: An Empirical Examination of New Derivatives Users, Journal of Accounting and Economics, 26, Issues 1-3, 319-351.

Guay, W.R. & Kothari, S.P. (2003): How Much Do Firms Hedge with Derivatives, Journal of Financial Economics, 70(3), 423-461.

Haushalter, G.D. (2000): Financing Policy, Basis Risk, and Corporate Hedging: Evidence from Oil and Gas Producers, The Journal of Finance, 55(1), 107-151.

Howton, S.D., & Perfect S.B., (1998), Currency and interest-rate derivatives use in U.S. firms, Financial Management 27, 111-121.

Jin, Y. and P. Jorion, (2004), "Firm Value and Hedging: Evidence from US Oil and Gas Producers," Journal of Finance 61, 893-917

Jensen, M.C. & Meckling, W.H. (1976): Theory of the Firm: Managerial Behaviour, Agency Costs and Ownership Structure, Journal of Financial Economics, 3(4), 305-360.

Josef, A. (2006); Derivatives Usage in the South African Mining Sector, Unpublished MBA Research Report, Johannesburg: University of the Witwatersrand.

Judge, A. (2006): Why and How UK Firms Hedge, European Financial Management, 12(3), 407-441.

Klimczak, K.M., Kozminski, L.,(2007), Risk Management Theory: A Comprehensive Empirical Assessment.Kozminski Working Paper No. 01-2007. Available at SSRN: http://ssrn.com/abstract=1031850

Leland, H.E., (1998), Agency Costs, Risk Management, and Capital Structure, The Journal of Finance, Vol. 53, 1213- 1243.

Mallin, C., Ow-Yong, K. and Reynolds, M., 2001, „„Derivatives usage in UK non-financial listed companies"", European Journal of Finance, 7(1), 63-91

Mello, A.S., Parsons J.E., & Triantis A.J., (1995), An Integrated model of Multinational Flexibility and Financial Hedging, Journal of International Economics, Vol. 39, 27-51.

Merrifield, A.J. (2001); Usage of Derivatives in Non-Financial Firms, Unpublished MBA Research Report, Johannesburg: University of the Witwatersrand.

Mian, S.L. (1996): Evidence on Corporate Hedging Policy, Journal of Financial and Quantitative Analysis, 31 (3), 419-439.

Minton B.A., Schrand C. *(1999), The impact of cash flow volatility on discretionary investment and the costs of debt and equity financing Journal of Financial Economics, 54 (3), pp. 423-460.

Modligliani, F. & Miller, M.H. (1958): The Cost of Capital, Corporate Finance, and the Theory of Investment, American Economic Review, 48(3), 261-297.

Moschini, G. & Lapan, H. (1995),The hedging role of options and futures under joint price, basis, and production risk. International Economic Review 36 , pp. 1025–1049

Murphy, P. (2003): Hedging in the Mining lndustry: Strategy, Control and Governance, 2003, Toronto, PricewaterhouseCoopers.

Myers, S.C. (1977): Determinants of Corporate Borrowing, Journal of Financial Economics, 5(2), 147-175.

Nance, D, Smith C. & Smithson C, (1993), 0n the Determinants of Corporate Hedging, Journal of Finance, Vol. 48, No. 1, 267-284.

Nguyen, H. & Faff, R. (2002): On the Determinants of Derivative Usage by Australian Companies, Australian Journal of Management, 27(1), 1-24.

Nguyen, H. & Faff, R. (2003): Further Evidence on the Corporate Use of Derivatives in Australia: The Case of Foreign currency and Interest Rate Instruments, Australian Journal of Management, 28(3), 307-317.

Phillips, A.L., 1995, 1995 Derivatives Practices and Instruments Survey, Financial Management, Vol. 24(2), 115-125

Prevost, A., Rose, L. & Millar, G. (2000): Derivative Usage and Financial Management in Large and Small Economies, Journal of Business Finance & Accounting, 27(5&6), 733-759.

Rajgopal, S. & Shevlin, T., (2002), Empirical evidence on the relation between stock option compensation and risk taking, Journal of Accounting and Economics 33 (2002), pp. 145–171.

Rothman, J. (2001), Derivatives Usage in Risk Management by Non-Financial South African Companies, Unpublished MBA Research Report, Johannesburg: University of the Witwatersrand.

Ross, Michael, (1997), Dynamic optimal risk management and dividend policy under optimal capital structure and maturity, Working paper, University of California, Berkeley.

Shapiro, A. C. & Titman, S.. (1986). An integrated approach to corporate risk management. In Joel M. Stern & Donald H. Chew, editors, The revolution in corporate finance. Boston: Blackwell.

Sheedy, E. (2006) .Corporate risk management in Hong Kong and Singapore,. Managerial Finance, 32(2), 89-100

Shivaram, S. & Shevlin, T. (2002): Empirical Evidence on the Relation between Stock Option Compensation and Risk Taking, Journal of Accounting

Smith, C. & Stulz R., (1985), The Determinants of Firms' Hedging Policies, Journal of Financial and Quantitative Analysis, Vol. 20, No. 4, 391- 402.

Smithson, C., and Simkins, B.J. 2005. "Does Risk Management Add Value? A Survey of the Evidence." Journal of Applied Corporate Finance 17: 8–17.Stulz, R.M. (1990): Managerial Discretion and Optimal Financing Policies, Journal of Financial Economics, 26(1), 3 - 27.

Stulz, R. M. (1996), Rethinking Risk Management. Journal of Applied Corporate Finance, 9: 8–25

Trueman, B. & Titman, S. (1988): An Explanation of Accounting Income Smoothing, Journal of Accounting Research, 26, Supplement, S127-S139.

Tufano, P. , (1996) , Who Manages Risk? An Empirical Examination of Risk Management Practices in the Gold Mining Industry, Journal of Finance, Vol. 51, No. 4, 1097-1137.

Tufano, P., (1998), Agency Costs of Corporate Risk Management, Financial Management, Vol. 27, No. 67-77.

Warner, J. (1977): Bankruptcy Costs: Some Evidence, Joumal of Finance, 32(2), 337-348.

Wall, L . & Pringle J. , (1989) , Alternative Explanations of Interest Rate Swaps: A Theoretical and Empirical Analysis, Financial Management, Summer 1989 , 59-73.

Annexure A: List of Mining Companies by

Country and Industry

South Africa		
Name	**Market Capitalisation as at 31/12/2009 (000,000's)**	**Industry**
General Mining		
EXXARO RESOURCES - MARKET VALUE	R 37,300	General Mining
AFN.RAINBOW MRLS. - MARKET VALUE	R 36,881	General Mining
ASSORE - MARKET VALUE	R 19,383	General Mining
MVELAPHANDA RES. - MARKET VALUE	R 10,533	General Mining
METOREX - MARKET VALUE	R 3,587	General Mining
MERAFE RESOURCES - MARKET VALUE	R 3,443	General Mining
SENTULA MINING - MARKET VALUE	R 1,678	General Mining
PETMIN - MARKET VALUE	R 1,071	General Mining
SEPHAKU HOLDINGS - MARKET VALUE	R 608	General Mining
MIRANDA MRL.HDG. - MARKET VALUE	R 173	General Mining
INFRASORS HOLDINGS - MARKET VALUE	R 135	General Mining
SALLIES - MARKET VALUE	R 96	General Mining
ABSOLUTE HOLDINGS - MARKET VALUE	R 48	General Mining
CHROMETCO - MARKET VALUE	R 22	General Mining
Plat.& Precious Metal		
ANGLO PLATINUM - MARKET VALUE	R 188,802	Plat.& Precious Metal
IMPALA PLATINUM - MARKET VALUE	R 128,204	Plat.& Precious Metal
NORTHAM PLATINUM - MARKET VALUE	R 17,313	Plat.& Precious Metal
WESIZWE PLATINUM - MARKET VALUE	R 1,237	Plat.& Precious Metal
VIL.MAIN REEF GDMNG.CO. (1934) - MARKET VALUE	R 7	Plat.& Precious Metal

Name	Market Capitalisation as at 31/12/2009 (000,000's)	Industry
Gold Mining		
ANGLOGOLD ASHANTI - MARKET VALUE	R 110,949	Gold Mining
GOLD FIELDS - MARKET VALUE	R 69,096	Gold Mining
HARMONY GOLD MNG. - MARKET VALUE	R 32,293	Gold Mining
SIMMER & JCK.MINES - MARKET VALUE	R 2,198	Gold Mining
WITS.CONS.GD.RES. - MARKET VALUE	R 2,120	Gold Mining
DRD GOLD - MARKET VALUE	R 1,909	Gold Mining
RANDGOLD & EXP. - MARKET VALUE	R 666	Gold Mining
JCI - MARKET VALUE	R 355	Gold Mining
PAMODZI GOLD - MARKET VALUE	R 47	Gold Mining
Diamonds & Gemstones		
TRANS HEX GROUP - MARKET VALUE	R 414	Diamonds & Gemstones
GOOD HOPE DIAS.(KIMB.) - MARKET VALUE	R 238	Diamonds & Gemstones
WHITE WATER RESOURCES - MARKET VALUE	R 70	Diamonds & Gemstones
KIMBERLEY CONS.MINING - MARKET VALUE	R 29	Diamonds & Gemstones
THABEX - MARKET VALUE	R 23	Diamonds & Gemstones
Iron & Steel		
KUMBA IRON ORE	R 97,727	Iron & Steel
ARCELORMITTAL SOUTH AFRICA	R 41,321	Iron & Steel
EVRAZ HIGHVELD STEEL VANADIUM	R 6,394	Iron & Steel
ARGENT INDUSTRIAL	R 867	Iron & Steel
BSI STEEL	R 432	Iron & Steel
AFRICA CELLULAR TOWERS	R 233	Iron & Steel
INSIMBI REFRACTORY & ALLOY SUPPLIES	R 143	Iron & Steel

Coal		
KEATON ENERGY HOLDINGS - MARKET VALUE	R 839	Coal
SOUTH AFN.COAL MNG.HDG. - MARKET VALUE	R 180	Coal
WESCOAL - MARKET VALUE	R 105	Coal
Nonferrous Metals		
PALABORA MINING	R 5,123	Nonferrous Metals
METMAR	R 762	Nonferrous Metals
Aluminum		
HULAMIN	R 2,921	Aluminum

Australia		
Name	**Market Capitalisation as at 31/12/2009 (000,000's)**	**Industry**
General Mining		
BHP BILLITON - MARKET VALUE	R 958,673	General Mining
RIO TINTO - MARKET VALUE	R 301,059	General Mining
OZ MINERALS - MARKET VALUE	R 24,400	General Mining
AQUILA RESOURCES - MARKET VALUE	R 23,719	General Mining
PANAUST - MARKET VALUE	R 10,976	General Mining
ILUKA RESOURCES - MARKET VALUE	R 9,930	General Mining
MURCHISON METALS - MARKET VALUE	R 7,145	General Mining
MINERAL RESOURCES - MARKET VALUE	R 6,908	General Mining
LYNAS - MARKET VALUE	R 6,031	General Mining
WESTERN AREAS - MARKET VALUE	R 5,953	General Mining
ATLAS IRON - MARKET VALUE	R 5,595	General Mining
CGA MINING - MARKET VALUE	R 4,112	General Mining
AUSENCO - MARKET VALUE	R 3,681	General Mining
INDEPENDENCE GROUP - MARKET VALUE	R 3,636	General Mining
CITADEL RESOURCE GROUP - MARKET VALUE	R 3,573	General Mining
INDOPHIL	R 3,400	General Mining
SUMMIT RESOURCES - MARKET VALUE	R 3,186	General Mining
MACMAHON HOLDINGS - MARKET VALUE	R 2,989	General Mining
CARBON ENERGY - MARKET VALUE	R 2,950	General Mining
STRAITS RESOURCES - MARKET VALUE	R 2,903	General Mining
AUSDRILL - MARKET VALUE	R 2,863	General Mining
SUNDANCE RESOURCES	R 2,782	General Mining
SANDFIRE RESOURCES - MARKET VALUE	R 2,635	General Mining
PERILYA - MARKET VALUE	R 2,318	General Mining
BROCKMAN RESOURCES - MARKET VALUE	R 2,175	General Mining
GRANGE RESOURCES - MARKET VALUE	R 2,055	General Mining
GIRALIA RESOURCES - MARKET VALUE	R 1,723	General Mining

REGIS RESOURCES - MARKET VALUE	R 1,695	General Mining
IVANHOE AUSTRALIA - MARKET VALUE	R 1,656	General Mining
JABIRU METALS - MARKET VALUE	R 1,519	General Mining
HIGHLANDS PACIFIC - MARKET VALUE	R 1,512	General Mining
AUSTRALASIAN RESOURCES - MARKET VALUE	R 1,466	General Mining
ALLIANCE RESOURCES - MARKET VALUE	R 1,356	General Mining
INTEGRA MINING - MARKET VALUE	R 1,301	General Mining
REX MINERALS - MARKET VALUE	R 1,298	General Mining
GALAXY RESOURCES - MARKET VALUE	R 1,254	General Mining
ARAFURA RESOURCES - MARKET VALUE	R 1,219	General Mining
SYLVANIA RESOURCES - MARKET VALUE	R 1,200	General Mining
FOCUS MINERALS - MARKET VALUE	R 1,191	General Mining
HILLGROVE RESOURCES - MARKET VALUE	R 1,170	General Mining

Name	**Market Capitalisation as at 31/12/2009 (000,000's)**	**Industry**
Plat.& Precious Metal		
ZIMPLATS HOLDINGS - MARKET VALUE	R 7,815	Plat.& Precious Metal
PLATINUM AUSTRALIA - MARKET VALUE	R 2,211	Plat.& Precious Metal
NKWE PLATINUM - MARKET VALUE	R 1,713	Plat.& Precious Metal
Gold Mining		
NEWCREST MINING - MARKET VALUE	R 113,211	Gold Mining
LIHIR GOLD - MARKET VALUE	R 51,469	Gold Mining
CENTAMIN EGYPT NPV (LON) - MARKET VALUE	R 8,283	Gold Mining
ANDEAN RESOURCES - MARKET VALUE	R 8,062	Gold Mining
KINGSGATE CONSOLIDATED - MARKET VALUE	R 5,945	Gold Mining
MEDUSA MINING - MARKET VALUE	R 4,199	Gold Mining
ST BARBARA - MARKET VALUE	R 3,816	Gold Mining

PERSEUS MINING - MARKET VALUE	R 3,753	Gold Mining
MINERAL DEPOSITS - MARKET VALUE	R 3,743	Gold Mining
AVOCA RESOURCES - MARKET VALUE	R 3,273	Gold Mining
RESOLUTE MINING - MARKET VALUE	R 2,673	Gold Mining
DOMINION MINING - MARKET VALUE	R 2,449	Gold Mining
ALLIED GOLD - MARKET VALUE	R 2,301	Gold Mining
OCEANAGOLD - MARKET VALUE	R 2,143	Gold Mining
CATALPA RESOURCES - MARKET VALUE	R 1,792	Gold Mining
TANAMI GOLD - MARKET VALUE	R 1,688	Gold Mining
GOLD ONE INTERNATIONAL - MARKET VALUE	R 1,680	Gold Mining
TROY RESOURCES - MARKET VALUE	R 1,385	Gold Mining
SILVER LAKE RESOURCES - MARKET VALUE	R 1,253	Gold Mining
Diamonds & Gemstones		
FLINDERS MINES - MARKET VALUE	R 1,748	Diamonds & Gemstones
Iron & Steel		
FORTESCUE METALS GROUP	R 91,046	Iron & Steel
BLUESCOPE STEEL	R 37,565	Iron & Steel
ONESTEEL	R 29,480	Iron & Steel
MOUNT GIBSON IRON	R 11,773	Iron & Steel
GINDALBIE METALS	R 4,966	Iron & Steel
NORTHERN IRON	R 2,104	Iron & Steel
CAPE LAMBERT RESOURCES	R 1,984	Iron & Steel
CENTREX METALS	R 1,354	Iron & Steel
IRON ORE HOLDINGS	R 1,218	Iron & Steel

Name	Market Capitalisation as at 31/12/2009 (000,000's)	Industry
Coal		
COAL & ALLD.INDS. - MARKET VALUE	R 45,543	Coal
NEW HOPE CORP. - MARKET VALUE	R 25,725	Coal
MACARTHUR COAL - MARKET VALUE	R 18,955	Coal
WHITEHAVEN COAL - MARKET VALUE	R 16,592	Coal
CENTENNIAL COAL - MARKET VALUE	R 10,035	Coal
RIVERSDALE MINING - MARKET VALUE	R 9,217	Coal
COAL OF AFRICA - MARKET VALUE	R 5,940	Coal
GLOUCESTER COAL - MARKET VALUE	R 4,941	Coal
GUJARAT NRE COKING COAL - MARKET VALUE	R 4,111	Coal
WHITE ENERGY - MARKET VALUE	R 3,738	Coal
SEDGMAN - MARKET VALUE	R 2,062	Coal
COCKATOO COAL - MARKET VALUE	R 1,436	Coal
Nonferrous Metals		
ENERGY RESOURCES OF AUSTRALIA	R 30,186	Nonferrous Metals
PALADIN ENERGY	R 19,858	Nonferrous Metals
EXTRACT RESOURCES	R 13,372	Nonferrous Metals
OM HOLDINGS	R 6,339	Nonferrous Metals
MINARA RESOURCES	R 6,266	Nonferrous Metals
MIRABELA NICKEL	R 5,874	Nonferrous Metals
KAGARA	R 4,676	Nonferrous Metals
CUDECO	R 4,599	Nonferrous Metals
MANTRA RESOURCES	R 3,849	Nonferrous Metals
PANORAMIC RESOURCES	R 3,149	Nonferrous Metals
ADITYA BIRLA MINERALS	R 2,564	Nonferrous Metals
MINCOR RESOURCES	R 2,361	Nonferrous Metals
DEEP YELLOW	R 2,312	Nonferrous Metals

Aluminum		
ALUMINA	R 29,744	Aluminum
CSR	R 18,115	Aluminum
BAUXITE RESOURCES	R 1,233	Aluminum

United Kingdom		
Name	**Market Capitalisation as at 31/12/2009 (000,000's)**	**Industry**
General Mining		
RIO TINTO - MARKET VALUE	R 610,355	General Mining
BHP BILLITON - MARKET VALUE	R 520,185	General Mining
ANGLO AMERICAN - MARKET VALUE	R 421,657	General Mining
XSTRATA - MARKET VALUE	R 389,242	General Mining
EURASIAN NATRES.CORP. - MARKET VALUE	R 139,208	General Mining
ANTOFAGASTA - MARKET VALUE	R 115,541	General Mining
VEDANTA RESOURCES - MARKET VALUE	R 84,120	General Mining
KAZAKHMYS - MARKET VALUE	R 83,977	General Mining
HOCHSCHILD MINING - MARKET VALUE	R 13,652	General Mining
AFRICAN MINERALS - MARKET VALUE	R 9,465	General Mining
ANGLO PACIFIC GROUP - MARKET VALUE	R 2,857	General Mining
GRIFFIN MINING - MARKET VALUE	R 800	General Mining
SUNKAR RESOURCES - MARKET VALUE	R 689	General Mining
MWANA AFRICA - MARKET VALUE	R 587	General Mining
VATUKOULA GOLD MINES - MARKET VALUE	R 575	General Mining
ZINCOX RESOURCES - MARKET VALUE	R 494	General Mining
EUROPEAN NICKEL - MARKET VALUE	R 484	General Mining
METALS EXPLORATION - MARKET VALUE	R 438	General Mining
OBTALA RESOURCES - MARKET VALUE	R 415	General Mining
OXUS GOLD - MARKET VALUE	R 415	General Mining
TITANIUM RESOURCES GP. - MARKET VALUE	R 393	General Mining
SIRIUS EXPLORATION - MARKET VALUE	R 350	General Mining
RAMBLER METALS AND MNG. - MARKET VALUE	R 341	General Mining
ANGLESEY MINING - MARKET VALUE	R 334	General Mining
BEACON HILL RES. - MARKET VALUE	R 325	General Mining
LANDORE RESOURCES - MARKET VALUE	R 325	General Mining

FRONTIER MINING - MARKET VALUE	R 294	General Mining
FRANCONIA MINERALS - MARKET VALUE	R 265	General Mining
EMERGING METALS (DI) - MARKET VALUE	R 264	General Mining
ALTONA ENERGY - MARKET VALUE	R 251	General Mining
KRYSO RESOURCES - MARKET VALUE	R 222	General Mining
NORTH RIVER RESOURCES - MARKET VALUE	R 219	General Mining
TANZANITE ONE - MARKET VALUE	R 218	General Mining
WEATHERLY INTERNATIONAL - MARKET VALUE	R 205	General Mining
ALEXANDER MINING - MARKET VALUE	R 176	General Mining
CHROMEX MINING - MARKET VALUE	R 156	General Mining
AMUR MINERALS CORP. - MARKET VALUE	R 146	General Mining
EDENVILLE ENERGY - MARKET VALUE	R 144	General Mining
RED ROCK RESOURCES - MARKET VALUE	R 121	General Mining
PAN PACIFIC AGGREGATE	R 120	General Mining
BAOBAB RESOURCES - MARKET VALUE	R 120	General Mining
ANGLO ASIAN MINING - MARKET VALUE	R 119	General Mining
VANE MINERALS - MARKET VALUE	R 95	General Mining
REGENCY MINES	R 95	General Mining
STRATEX INTERNATIONAL - MARKET VALUE	R 92	General Mining

United Kingdom		
Name	**Market Capitalisation as at 31/12/2009 (000,000's)**	**Industry**
Plat.& Precious Metal		
FRESNILLO - MARKET VALUE	R 67,105	Plat.& Precious Metal
LONMIN - MARKET VALUE	R 44,690	Plat.& Precious Metal
AQUARIUS PLATINUM - MARKET VALUE	R 40,135	Plat.& Precious Metal
JUBILEE PLATINUM - MARKET VALUE	R 793	Plat.& Precious Metal
ARIAN SILVER - MARKET VALUE	R 114	Plat.& Precious Metal

Gold Mining		
RANDGOLD RESOURCES - MARKET VALUE	R 53,169	Gold Mining
PETROPAVLOVSK - MARKET VALUE	R 22,027	Gold Mining
HIGHLAND GOLD MINING - MARKET VALUE	R 3,477	Gold Mining
AVOCET MINING - MARKET VALUE	R 2,432	Gold Mining
ARCHIPELAGO RES. - MARKET VALUE	R 1,455	Gold Mining
PATAGONIA GOLD - MARKET VALUE	R 1,262	Gold Mining
PAN AFRICAN RESOURCES - MARKET VALUE	R 1,195	Gold Mining
NORSEMAN GOLD - MARKET VALUE	R 1,101	Gold Mining
CLUFF GOLD - MARKET VALUE	R 919	Gold Mining
AFRICAN CONS.RESOURCES - MARKET VALUE	R 603	Gold Mining
EMED MINING PUBLIC - MARKET VALUE	R 462	Gold Mining
HAMBLEDON MINING - MARKET VALUE	R 419	Gold Mining
CHAARAT GOLD HDG.(DI) - MARKET VALUE	R 417	Gold Mining
PENINSULAR GOLD - MARKET VALUE	R 382	Gold Mining
TRANS SIBERIAN GOLD - MARKET VALUE	R 311	Gold Mining
MARIANA RESOURCES - MARKET VALUE	R 273	Gold Mining
GMA RESOURCES	R 205	Gold Mining
ANGEL MINING - MARKET VALUE	R 200	Gold Mining
GOLDPLAT - MARKET VALUE	R 158	Gold Mining
BEZANT RESOURCES - MARKET VALUE	R 152	Gold Mining
AFRICAN EAGLE RESOURCES - MARKET VALUE	R 149	Gold Mining
ASCOT MINING	R 116	Gold Mining
SOLOMON GOLD - MARKET VALUE	R 105	Gold Mining
CENTRAL AFRICAN GOLD - MARKET VALUE	R 104	Gold Mining
SHANTA GOLD - MARKET VALUE	R 90	Gold Mining
CHINA GOLDMINES - MARKET VALUE	R 79	Gold Mining

Name	Market Capitalisation as at 31/12/2009 (000,000's)	Industry
United Kingdom		
Diamonds & Gemstones		
GEM DIAMONDS (DI) - MARKET VALUE	R 3,708	Diamonds & Gemstones
PETRA DIAMONDS - MARKET VALUE	R 2,531	Diamonds & Gemstones
NAMAKWA DIAMONDS (DI) - MARKET VALUE	R 445	Diamonds & Gemstones
FIRESTONE DIAMONDS - MARKET VALUE	R 395	Diamonds & Gemstones
KOPANE DIA.DEVELOPMENTS - MARKET VALUE	R 386	Diamonds & Gemstones
AFRICAN DIAMONDS - MARKET VALUE	R 333	Diamonds & Gemstones
GEMFIELDS - MARKET VALUE	R 201	Diamonds & Gemstones
SANATANA DIAMONDS	R 74	Diamonds & Gemstones
Iron & Steel		
FERREXPO	R 13,804	Iron & Steel
INTERNATIONAL FERRO METALS	R 1,996	Iron & Steel
Coal		
UK COAL - MARKET VALUE	R 2,634	Coal
CALEDON RESOURCES - MARKET VALUE	R 1,191	Coal
CHURCHILL MINING - MARKET VALUE	R 927	Coal
GCM RESOURCES - MARKET VALUE	R 464	Coal
ATH RESOURCES - MARKET VALUE	R 443	Coal
BISICHI MINING - MARKET VALUE	R 216	Coal
STRATEGIC NATURAL RES. - MARKET VALUE	R 122	Coal
PALMARIS CAPITAL - MARKET VALUE	R 117	Coal
ATLANTIC COAL - MARKET VALUE	R 110	Coal

Nonferrous Metals		
KALAHARI MINERALS	R 4,300	Nonferrous Metals
AFRICAN COPPER	R 572	Nonferrous Metals
NIGER URANIUM (DI)	R 408	Nonferrous Metals
GLADSTONE PACIFIC NICKEL	R 142	Nonferrous Metals
TOLEDO MINING	R 123	Nonferrous Metals